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WORLD'S DAIRY CONGRESS.

THE eighth World's Dairy Congress which lasted for two weeks and concluded in the middle of July, was held for the first time this year in Great Britain under the patronage of the King with the Ministers of Agriculture and Health as two of its Presidents and Lord Desborough as Chairman of the General Committee. The magnitude and importance of the event which was organised by the International Dairy Federation, whose headquarters are in Brussels and by the National Farmers' Union and the British Dairy Farmers' Association, was shown by the fact that there were sixteen hundred delegates from forty-seven different countries present. With such a representative assembly of scientific experts, practical dairymen, doctors and dietetic specialists there is no doubt that the good results already achieved by the previous Congresses have been intensified and that much useful information of an international character has been interchanged to further the development of all sections of the dairy industry and of public health.

Milk, in a pure and safe form and as an essential factor in national health has become more necessary but more difficult to obtain under modern conditions of life in congested areas, and it is towards the solution of this problem and of many others connected with the manufacture of dairy products that the Congress has directed its activities. Another of its objects was to focuss public attention on the unique food properties of milk and on the advantages of increasing its consumption and that of its by-products. This propaganda work is very necessary when it is remembered that in no country has milk consumption reached the point which is scientifically recognised as desirable in the interests of human welfare. Although there has been a marked increase in the number of dairy cattle in the United Kingdom in the past few years, due in part to the increasing popular demand for milk products, the consumption of milk per head of population is still very low and amounts to less than half a pint per head per day. One of the factors which has led to this relatively low consumption of milk in the past has been the lack of confidence in its cleanliness, but the Medical Officer for Health of London recently stated the surprising fact that whereas in 1921 no less than 25 per cent. of the samples of milk taken contained tubercular bacilli, in 1925 the percentage had fallen to 2.4 and in 1927 not a single sample contained the bacilli. This is a remarkable

testimony to the administration of the laws and bye-laws relating to pure milk and, beyond question, a great improvement has taken place though few will contend that perfection has been reached.

The problems considered at the Congress fell into four main groups: milk production, milk distribution and manufacture, milk consumption and the aspects of the official administration and control of the dairying industry. In addition to the papers read and discussed at the Central Hall, Westminster, Reading and Edinburgh, tours were conducted to dairy establishments and milk producing farms, including the royal dairy at Windsor.

In the section on milk production much attention was of course given to the problems of feeding and management of milk cows and no fewer than six important papers were read. The principles governing the selection of rations, winter and summer feeding, the protein requirements of cows and the effects produced on the richness of cows' milk by feeding cod-liver oil were amongst the most important subjects dealt with. An investigator also claimed that when a spray of milk is treated with ultra violet light of a certain wave length prophylactic and therapeutic properties with reference to rickets had been produced. From the Austrian delegate it appeared that dairy education had reached a very high level in that country and he advocated that only persons with university, secondary school, or technical education should be employed. It was learnt also that in Hungary according to new trade regulations, only persons possessing adequate knowledge and requisite qualifications might be engaged in butter and cheese making.

In the section of milk distribution and manufacture a most valuable contribution was made on metals and their influences on milk and as a result of a comprehensive investigation, certain metals have been classified with reference to their suitability for general use in dairy equipment from the standpoint of resistance to corrosion and effect on milk products. The best metals were found to be superascoloy (chromium nickel steel), tin and nickel while tinned iron, copper, galvanised iron, iron and zinc were placed last on the list.

There were special scientific sections on dairy bacteriological and chemical technique at Reading and a particularly interesting paper was read on the use of the methylene blue test in the grading of milk, the principle of the test being the decolorisation of methylene blue by bacteria which can only be used with the fermentation test as by itself it does not indicate the type of bacteria present. It was believed that the judicious use of this test would go far in deciding whether milk is wholesome or not and how it can be graded. In the dairy chemical technique section modern methods of laboratory control were dealt with and some data given as to the lay-out and running expenses of the laboratories. It was stated that a German Dairy Company which receives 40,000 to 50,000 gallons of milk daily from distances up to 200 kilometres had a laboratory staff consisting of a chief, two doctors, three laboratory workers, each in the chemical and bacteriological departments, three samplers in the dairy and three in the country.

A paper was also contributed on the natural variation in the composition of milk and the difficulties encountered in distinguishing between abnormal and adulterated milk; it was found that the two most promising methods for such distinction are of a physical nature: (1) the depression of the freezing point of milk and (2) the refractive index of milk serum. Both methods depend on the proportions of soluble substances in milk of which the most important are lactose and mineral salts.

It is impossible here to discuss all the papers that were read and the general outline just given will have to suffice to show how the Congress has set to work to enlighten the world with the recent discoveries made by its delegates. It is unfortunate that modern dairying practices have yet hardly developed in the tropics, where there are very great difficulties to overcome before a proper system for producing an adequate supply of milk can be organised. At the present time it is generally recognised that there is a distinct shortage of milk in most of the countries lying within the tropics and especially is this the case in certain parts of India where a great many children still die of rickets and where milk is on the average of very poor quality, expensive and often adulterated. Dairying in India is mostly in the hands of poor, uneducated small holders who have no organising ability and no technical knowledge as to the treatment of milk and of the first principles of clean milk production. Ignorance on the subject of cleanliness is such that an authority has stated that there is a prejudice amongst certain Indian consumers against pasteurized milk! The number of cattle is far in excess of the food available, so that a great many of them are undersized and underfed. In certain parts of East Africa one of the chief problems is disease and it will be quite impossible to start a dairy industry unless some measure of control has been secured against East Coast fever and the ravages of the tsetse fly. As has been shown in a previous article published in this Journal clean milk can be produced in the tropics on up-to-date lines and there is no reason why more dairies should not be established wherever a supply of wholesome milk is required. In Trinidad the dairying industry is almost entirely in the hands of Indians and is said to be in a flourishing state. Further, much useful work has been done at the Government Farm with regard to the breeding of suitable dairy cattle and the stock of the island should gradually benefit if proper use is made of the stud animals that are available. The whole problem of the dairy industry in the tropics remains with the native as it is he who owns most of the cattle and steps should be taken, as they have already been taken in some places, to educate him with a view to using and producing more milk by adopting improved methods of breeding, feeding and rearing.

MALAYA RUBBER INSTITUTE.

By Dr. G. Bryce,
Director of the Rubber Research Institute of Malaya, Kuala Lumpur, Federated Malay States.

The Rubber Research Institute of Malaya was established at the desire of the rubber-growing industry to make provision for the application of science to the rapidly increasing problems of the industry, to make that provision on a larger scale and in an Institute specially devoted to the needs of the industry, and to combine in one centre the scientific work which had, heretofore, been carried out by several Independent bodies in the country.

With the formation of the Institute, The Rubber Growers' Association Research Laboratory and the Malay Peninsula Agricultural Association Research Laboratory were closed down and scientific work on rubber was transferred from the Agricultural Department to the Institute. The other laboratories had been closed down some time previously.

Prior to the formation of this Institute scientific work in Malaya for the rubber industry had been carried out by:—

(*a*) the Agricultural Department, Kuala Lumpur, S.S. and F.M.S.
(*b*) the Rubber Growers' Association Research Laboratory near Kuala Lumpur.
(*c*) the Malay Peninsula Agricultural Association Research Laboratory near Penang.
(*d*) the Société Financière des Caoutchoucs Research Laboratory near Kuala Lumpur.
(*e*) Scientific Officers attached to various individual Companies.

The governing body, the Board of the Rubber Research Institute of Malaya, was incorporated by Enactment of the F.M.S. in 1919, and the means to finance the Institute were found by placing an export tax on rubber leaving Malaya. This export tax amounts to 10 Straits dollar cents per picul of 133⅓ lb., which brought in about $386,000 in 1926 or about £45,000. As the revenue, thus derived, comes from the produce of large estates, small Asiatic estates and native holdings, it is apparent that a duty devolves on the Institute to provide for the needs of all rubber producers in the country. Statistics show that there are in Malaya 100,000 to 110,000 rubber small holdings under 25 acres and 1,700 small holdings between 20 and 100 acres. All holdings of the first class and the greater number of the second class are under Asiatic ownership or control. In 1925, of the standard production of rubber, 44 per cent. came from the small holder or the Asiatic proprietor.

The nature of the scientific work required by the large estates is fairly clear, but the aid to be given to the small Asiatic estates and the native holders can only be determined by the nature of their problems when these are ascertained. Certain problems such as those of soil conservation and disease control are known to exist but, under the dense stand of trees typically maintained on small holdings, these problems probably assume a somewhat different aspect and require different treatment from that accorded to similar problems on large estates.

The Institute will be concerned with all problems and matters relating to the cultivation and preparation of rubber. The scientific work of the Institute will thus be directed toward establishing the facts that influence the production and preparation of rubber and to the discovery and application of fundamental principles for the benefit of the industry. The Institute will also undertake the supply of scientific and technical information and will provide for the dissemination and utilisation in the industry of such new knowledge as it may acquire.

The objects and aims of industrial research, *i.e.*: the functions of an industrial research association, have been indicated by the Advisory Council of the Department of Scientific and Industrial Research in its 1925-26 Report.

"Applied scientific research (or industrial "research) has two main objects—improvement "of existing and introduction of new industrial "methods and processes.". . .

"Thus the research with which we are concerned "is practical in aim, whether it be pure or applied "research, and it shows this intention throughout. "The choice among the multitudinous lines of "advance is determined by the practical "considerations of where the material advantage "is most likely to lie. Between two problems "both offering the same probability of solution, "if success in one will produce a big saving or profit "and in the other a relatively small improvement "there should be no difficulty in choosing. The "difficulty often lies in estimating the relative "importance of the alternative problems in the "cost of production. This difficulty can only "be removed by an economic study of the industry "from the research standpoint. We are not sure "that enquiries of this kind have been sufficiently "prosecuted in the past by industrial research "workers.". . .

"The justification for all the expenditure on "industrial research which we may recommend "must rest in the essentially practical aim of the "work; and in all the measures adopted by the "Department to carry out or to promote industrial "research, the primary purpose must be to secure "the application of scientific knowledge in "industry."

The foregoing extracts outline the objects and aims of an industrial research association, and express the attitude which this Institute should adopt in its scientific work for the rubber-growing industry. Briefly stated, it amounts to this that the work of the Institute should lead to lower costs of production in the industry and at the same time should enable the industry to maintain itself in face of increasing competition from outside and to safeguard its future prosperity.

Organisation of Research Staff.

In the past, scientific work for the rubber-growing industry in the Eastern Tropics was directed mainly toward pathological problems and scientific appointments generally went to "Mycologists." The Mycologist, however, as

his work progressed and as he accumulated experience, found that he was frequently unable to advance further in his own investigations until the lack of information on basic physiological and soils problem was made good. In the absence of workers in these branches he had perforce to attempt the work himself. A study of the staffs of Colonial Agricultural Departments will reveal the fact that, besides pathology, the mycologist, in many cases, had to undertake responsiblilty for practically the whole field of agricultural research save that of entomology. This, of course, resulted in progress being slow and in inadequate investigation in the other branches.

Of recent years, however, the tendency in the Tropics both among scientific workers and practical planters, has been toward a deeper realisation of the fundamental importance of problems of crop improvement and soil management. In the rubber-growing industry these matters are the burning questions of the day, and so urgent is the demand for information from the industry, that it is at all times necessary to emphasize the tentative nature of much of the existing information and to stress the need for investigation to establish the facts. In planting circles, interest in crop improvement and soil management has been awakened by the prospect of obtaining, through bud-grafting from high yielding trees, a greatly improved stand of trees from the cropping point of view and by the marked results obtained on poor soils from the application of nitrogenous manures. Interest has also been stimulated by the fact that yield from old rubber trees in certain districts either remains stationary or tends to fall off. The work of the research associations in the Nederlands East Indies and its increasing importance to the industry there has had its effect in awakening a demand for a greater measure of scientific work in Malaya. In organising the scientific work of the Rubber Research Institute it was considered essential that adequate provision be made for investigations into crop improvement and soil management as central functions of the Institute.

An important process on rubber plantations, and one on which the market value of the rubber closely depends, is that of the preparation of rubber from latex. To provide for the investigation and information required by the industry and to examine new methods of preparation necessitated the appointment of staff for this purpose.

The disease situation requires constant attention. This and the extension of pathological work to cover a wider field, including, *inter alia*, the epidemiology of the diseases of the rubber tree in Malaya, make a pathological service necessary in the Institute.

Finally, in view of the nature of the investigations required, of the interrelated problems of "soil conditions and plant growth," in Sir E. J. Russell's phrase, and of the necessity, in face of our general lack of knowledge of tropical crops, of providing a team of workers capable of attacking the central problems simultaneously from different aspects, it was considered essential that the work of the different branches should be placed in the hands of able and experienced workers.

The research staff of the Institute may be thus regarded as falling naturally into a Botanical Division concerned with anatomical, physiological and plant breeding investigations; a Chemical Division concerned with the technological problems involved in the coagulation of latex and the preparation of rubber for the market; a Soils Division concerned with physical investigations on soils, physical work on latex, biology of soils, and meteorological observations; a Pathological Division concerned with diseases and pests of rubber, and the epidemiology of rubber diseases in Malaya.

Though for convenience of administration the staff is separated into Divisions, it is clear that, as far as work is concerned, these are not water-tight compartments. A striking feature of the present-day application of science in industry is the attack on central problems by teams of workers. In view of the interrelated nature of agricultural problems, where the solution of one problem may involve investigations in several branches of science, team work may be regarded as a necessary condition of success.

It is commonplace knowledge that there is frequently, if not usually, great delay between the attainment of scientific results of importance to industry and their practical application in industry. The Advisory Council of the Department of Scientific and Industrial Research puts the matter thus :—

> "It is one of the most important parts of the "Department's own research organisation to "establish utilisation sections for promoting the "application of scientific and technical information "in industry. The same function must be discharged "by research associations wherever they exist, "indeed we regard this function as being in many "cases perhaps the most important function which "the research association can discharge."

To ensure rapid dissemination of any advance in knowledge resulting from research work at the Institute, and to make more easily available to planters such technical information as is already available, it was decided that Field Officers should be appointed.

It would be part of the duty of the Field Officers to inspect small holdings and small Asiatic estates. This would furnish the research side of the Institute with information as to conditions on small holdings and thus serve to indicate the lines along which work could most profitably be directed on their behalf. The Field Officers would maintain close contact, on this side of their activities, with the Rubber Agriculturist of the Co-operative Societies

Department whose work lies in this direction. Information of importance to the whole planting industry may be obtained in particular from a study of the disease problems of small holdings and of the method of dense planting adopted on them.

These Field Officers are to be placed at the headquarters station of the Institute, and are to go out on tours of duty, returning to headquarters on completion. It might be urged that the obvious method to adopt is to allot a Field Officer to a planting district and to let him live and work there. The danger of this method, however, lies in the fact that any scientific officer placed in such a position of isolation rapidly loses his scientific outlook, his opportunities of keeping in touch with the research work at headquarters are too infrequent, and in the end he is of little value as a connecting link between the researcher in the laboratory and the planter on the estate. On the other hand, operating from headquarters, to which he returns on completion of a tour of duty, he can keep in touch with the scientific work in hand and at headquarters can work on problems in course of investigation particularly on the experiment station.

The Field Officers, on their frequent return to headquarters, will bring their field observations and the problems they have encountered on estates to the notice of the research officers concerned. The research officers will, thus, be enabled to keep in touch with conditions over many planting districts, and on the knowledge thus gained, they will be able to arrange their own visits to the planting districts to the best advantage. They will also be able to direct the Field Officers in the investigation of any problems which the latter may be required to undertake. The Field Officers will also, in course of time, be employed on a survey of the soils of rubber planting districts and on a survey of the incidence of rubber diseases. The soil survey should provide information of considerable practical importance in determining the effect of soil conditions on yield of latex.

Experiment Station.

An agricultural research institute may be regarded as consisting of two mutually essential parts, namely, the farm or experiment station and the laboratory. At the Rothamsted Experiment Station, it is stated that "the general method of investigation is to start from the farm and work to the laboratory or *vice versa*." The same general method of investigation will be followed at this Institute. Land, on which to establish an experiment station, is therefore required.

As rubber is grown as a perennial crop and as, in its culivation, an acre of land is made to carry only some 80 to 100 individual plants, it was evident from the beginning that an experiment station for research work on rubber, if it is to serve this purpose adequately, must have at its disposal a considerably larger area of land than is usually devoted to annual crops on experiment stations in temperate zones. In addition to the plots on which basic experiments are to be conducted, it is of some importance that larger areas should be available on which results obtained from small scale experiments can be tried out on a larger scale. Finally, a large area is necessary for the plant breeder to try out the results of his selection work. From a consideration of these points I concluded that an area of at least 2,000 acres would be necessary to make adequate provision for the rapid extension of work that was bound to come. The Government of the Federated Malay States has generously placed 2,000 acres of land at the disposal of the Institute for the purpose of its experiment station. This land is situated in the most convenient area of forest reserve possible and will be distant some 15 miles from the Laboratory of the Institute when the necessary approach road is constructed.

The development and maintenance of the Experiment Station will involve the employment of a considerable labour force and the preliminary operations of felling, clearing and planting will entail knowledge and experience of estate practice in those field operations. The Manager of the experiment station should therefore be a planter and preferably one who has an active interest in scientific work for the industry. The establishment of the Experiment Station will also require a considerable outlay of capital and a considerable annual outlay on maintenance. The funds at present at the disposal of the Institute are insufficient to meet these liabilities adequately. On the other hand, revenue should accrue from the Experiment Station when the rubber comes into bearing. It would therefore be of the greatest advantage, from all points of view, if the financial side of the Experiment Station were organised on a business basis, and its accounts drawn up as for a rubber estate, and this has been decided upon.

Information Bureau and Library.

There must be, amongst planters of experien ce, a considerable body of information and of field knowledge which in general is not recorded and tends to become lost to the industry when a planter retires from the country. Much of this information is of great value, for example, field results obtained from cultural operations. Such experience and information in farming circles at home usually finds its way into farming or agricultural journals, or becomes part of local tradition or of accepted farming practice and is thus preserved. Conditions on rubber estates in the tropics are unfavourable to the building up of an accepted practice or tradition owing to the comparatively frequent change in the personnel of any one district. Thus when the older planters retire from the country the knowledge and experience which they have gained is lost to the industry. It is

desirable, therefore, that estate and planting information and experience be collected, summarised and published. From these summaries many indications would be obtained of promising lines of investigation.

Again there are other cases where information is on record on estate books that may be regarded as private and thus never becomes current knowledge. Such estate records are of great value in investigations into the influence of soil on yield. In order that these records may be made available for scientific investigation at the Institute, it would appear desirable that the staff of the Institute should undertake formally to regard estate records, where the estate does not desire these to become public but is prepared to communicate them to the Institute, as being of a confidential nature. The importance to the Institute of estate records and field data cannot be overestimated and it is well worth while endeavouring to make it possible for them freely to reach the Institute. The collection and summarising of such records will involve a considerable amount of labour, and such work can most advantageously be placed in the hands of the officer in charge of the Information Bureau. The Information Bureau has come to be a recognised portion of the mechanism of industrial research associations in Great Britain, and its functions are as important to the industry as they are to the research association. The functions of the bureau are mainly to act as a clearing house for information going out to or coming in from the industry. It abstracts or indexes current literature and issues to the staff a summary sheet or index. In our case it would assemble available statistics dealing with the industry and would endeavour by its own activities to supplement or complete these from direct enquiries. The library has already grown sufficiently to warrant special attention and the card indexing will require individual attention. This would be an important charge on the Information Bureau.

Internal Committees.

To provide for regular contact between Divisions of the Institute for discussion and consultation on work in hand and on fresh problems as they arise internal committees have been created. A weekly meeting of Senior Officers with the Director had already been inaugurated, and this has now been established as an internal Laboratory Committee. Its functions are to discuss work in hand and to report progress, to examine fresh problems as they arise and to develop a concerted plan of attack, to act as referees on papers, sent in for publication before these are submitted to the Board of the Institute for authority to publish, and to deal with such other internal research matters as may arise.

Applications for patent rights in connection with processes on rubber estates are forwarded by Government to the Institute for report. These will be examined by a Staff Patents Committee which will report on the various aspects of such applications for patent rights.

Publications.

The intention, at present, is that two series of publications be issued by the Institute under the authority of the Board, a research series and an estate series. In the latter the subject matter will be presented in suitable form for planters. In both cases publication will be by authority of the Board.

The research series will contain scientific papers emanating from the Institute and its object will be to place on record the results of scientific investigations and to bring these before scientific workers elsewhere to obtain that criticism and discussion which is of great value to workers in science. The estate series is designed for planters and will convey in non-technical language the scientific results published in the technical series. It will also contain information and educational matter on planting subjects which it is considered desirable to bring to the notice of planters. Simple non-technical informative articles printed in Malay and Chinese, should serve a useful educational purpose amongst small estate and small holders. This contact with small holders could be made through articles contributed to the Agricultural Department publications in Malay and Chinese, and it is probable that this may form the most convenient method of distributing information to them.

It has been decided that a London Advisory Committee be formed to link up the research work being carried out in Malaya, Ceylon and South India. The matter is still under discussion. Apart from the work of the London Advisory Committee it is of great importance that the Institute should maintain the closest, direct contact with workers in Ceylon, South India and the Netherlands East Indies. Collaboration with officers of the Agricultural Department, S.S. and F.M.S., on problems of mutual interest should be of mutual advantage. On many matters of scientific interest to the researcher in Malaya it will be found to be of the greatest advantage to keep in touch with research workers at home, and particularly with industrial research associations in their general policy and attitude towards the scientific needs of the industries for which they work.

Preliminary Programmes of Work for the coming year have already been drawn up. These could usefully be discussed by a Research Committee consisting of planting members of the Board and of co-opted members drawn from among leading planters in Malaya. The Committee would be attended by the Director and the Heads of Divisions of the Institute. The Institute staff stands to gain much from a discussion with responsible planters of planting problems and of investigations at the Institute. A Committee has been established, more or less experimentally, along these lines.

The structure of the Institute should not be regarded as rigid and unalterable. As our work progresses and as experience accumulates there will, no doubt, emerge changes which could advantageously be made. It is important, therefore, to recognise now the advantage of such a flexibility in organisation as will enable future changes or modifications to be made in the Institute to meet changes or changing conditions in the industry. A similar adaptability should attach to our programmes of work.

Laboratory Building.

A large two-storey bungalow, with a spacious central hall, has been taken over as a laboratory building and has been altered and extended to provide the requisite accommodation for the staff. A water supply has been installed, and the building is being connected to the town electric supply. A steam supply is run into the working rooms from an outside boiler.

For investigations into estate factory problems a set of three small power-driven rollers have been mounted and a smoke-house and air-drying chamber built. Vulcanising plant has been lent to the Institute by courtesy of the Agricultural Department, F.M.S. and S.S. Apparatus and chemicals are now arriving in response to orders sent off and it is expected that at an early date all Divisions of the Institute will be fully equipped.

Staff List.

Director.—G. Bryce, D.SC. (Edin).

BOTANICAL DIVISION.

Head.—F. Summers, D.S.O., M.C., B.A. (Cantab), B.SC. (London), M.SC. (L'pool), late Head of the Botany Department of the British Cotton Industry Research Association, formerly Economic Botanist to the Government of Ceylon, and later a member of the Research Staff of the Home Ministry of Agriculture.

Plant Breeder.—L. E. Morris, M.A., Dip. Agr. (Cantab), B.SC. (Lond.). Formerly Senior Botanist, British Cotton Industry Research Association.

Biochemist.—E. Rhodes, PH.D., M.SC. (Leeds). Late Demonstrator in Plant Chemistry and Physiology, University of Leeds, and Biochemist to the British Cotton Industry Research Association.

Plant Physiologist.—C. E. T. Mann, M.SC. (London). Late Plant Physiologist at the Long Ashton Horticultural Experiment Station, University of Bristol and Ministry of Agriculture.

Technician.—H. Gunnery, late technologist in the British Cotton Industry Research Association.

CHEMICAL DIVISION.

Head.—B. J. Eaton, O.B.E., F.I.C., F.C.S., F.I.R.I., Hon. Consulting Adviser and Member, Rubber Division, Am.Chem.Soc.; Agricultural Chemist since 1909; Acting Director of Agriculture and Secretary for Agriculture on several occasions. Seconded for service for a period of three years with the Rubber Research Institute.

Chemist.—R. G. Fullerton, B.SC. (Aberdeen). Distinction Chem. 1923. Graduated M.A. with Hons. Mathematics and Physics, 1925. Awarded Robbie Prize Chem., 1923.

PATHOLOGICAL DIVISION.

Head.—J. R. Weir, B.A. (Indiana), PH.D. (Munich). Botanical Fellow of Harvard University, and late Forest Pathologist in the United States Department of Agriculture. As a member of the U.S.A. Expedition on rubber in the Amazon Valley he prepared the official report on the results of the expedition.

Pathologist.—A R. Sanderson, F.L.S., late Rubber Growers' Association's Research Laboratory, Petaling. Joint author of a monograph "Brown Bast."

Pathologist.—H. Sutcliffe, A.R.C.S., F.L.S., F.R.MICROS.SOC., late Rubber Growers' Association's Research Laboratory, Petaling. Joint author of a monograph "Brown Bast."

SOILS DIVISION.

Head.—W. B. Haines, D.SC. (London), PH.D. (Gottingen), F.INST.P., F.R.MET.SOC., D.I.C., late 1851 Exhibitioner of University College, London, and Beit Fellow of the Imperial College of Science and Technology, late Assistant Physicist, Rothamsted Experimental Station.

Bacteriologist.—A. S. Corbet, PH.D., B.SC. (London). Formerly demonstrator in Agricultural Chemistry University of Reading, and Bacteriological Chemist in the School of Agriculture, University of Cambridge.

Soils Chemist.—C. F. Flint, B.SC. (London), A.I.C., A.R.C.S.

FIELD OFFICERS.

F. Billington, M.A., DIP.AGR. (Cantab.).
N. C. Jenkins, M.A., DIP.AGR. (Cantab.).
F. Beeley, B.SC. (Leeds).

OFFICE.

Secretary:—V. L. Cachemaille.

A beginning was made on the organisation of the Rubber Research Institute in October, 1926, at which time the Director assumed duty. The present stage of organisation has thus been reached in 15 months' work. The progress made may reasonably be considered to be rapid, and that it has been so, may be attributed to the fact that the Controlling Board is organised on a business basis, and that it has thus been possible to obtain decisions quickly and to act rapidly.

MR. ORMSBY-GORE'S TOUR.

Tropical Agriculture in Malaya, Ceylon and Java.

[*The following extracts are taken from a paper read by the Right Hon. W. Ormsby-Gore,* M.P., *Parliamentary Under Secretary of State for the Colonies, to the Royal Colonial Institute, on his recent tour to Malaya, Ceylon and Java.*—ED.]

BRITISH MALAYA lies between the Equator and 7° north. It has an area of approximately 53,000 square miles, *i.e.*: it is very little smaller than England (without Wales), and contains a mixed population of Chinese, Malays, Indians and Europeans, totalling approximately 4,000,000. It is only very partially developed economically, the greater portion of the Peninsula is still virgin jungle. The climate is amazingly uniform and monotonous. There is no winter and no cessation of plant growth. The rainfall throughout the year, brought by the north-west monsoon from October to March, and by the south-west monsoon from April to September, varies according to altitude from some 60 inches a year in the driest area to 250 inches a year on the mountains. The temperature hardly varies seldom going, at the lower levels, below 70° at night, or exceeding 90° in the shade on the hottest day.

Ceylon lies between 6° and 10° north of the Equator. It is about half the size of British Malaya. It contains a population of over 5,000,000. Half the Islands, namely, the central uplands and the west and south-west are climatically similar to Malaya, *i.e.*: they get both monsoons and have a rainfall ranging from 100 inches to 300 inches a year, widely distributed throughout the year. Ceylon, however, has two dry zones, one in the north-west and one in the south-east, and each of these zones only gets the north-east monsoon in the winter months—if winter it can be called. The total rainfall in these areas varies between 25 inches and 60 inches a year. Both these dry zones are uniformly low lying.

Java lies between latitude 4° and 8° south of the Equator. In area it is almost exactly the same size as British Malaya *i.e.*: it is slightly smaller than England. It contains, however, no less than 38,000,000 inhabitants. In this it is unique in the Malay Archipelago for the whole of the rest of the Dutch East Indies—some 14 times the area of Java—have between them only 14,000,000 inhabitants. Climatically it is very similar to Malaya, it gets both monsoons, although the south-west monsoon in their winter months, namely, June, July and August, is very scanty in the central and eastern portions of the Island, and in those months irrigation becomes of the first importance.

Ceylon is more developed than Malaya, and Java is more developed than Ceylon. In fact Java is cultivated throughout the plains and right up to the mountain sides, up to an altitude of about 6,000 feet, and the only natural jungle left are the forests on the high mountain tops which are conserved for hydrological purposes.

Whereas in Malaya and Ceylon the soil consists of alluvial deposits and the results of attrition and erosion of the ancient igneous rocks which form the geological basis of both, the similar geological basis of Java has been intruded in much more recent times by a long chain of volcanic peaks, many of them still active, which have introduced a new factor from the agricultural point of view lacking in the other two otherwise similar countries.

Owing to the pressure of population upon land in Java there has been far greater necessity forced upon the Government and population to get the utmost out of every acre of soil that has been harnessed to the needs of man. Whereas in Malaya and Ceylon there is still unoccupied land capable of cultivation to be brought under cultivation, in Java it is entirely a problem of intensifying production upon land already harnessed. This no doubt accounts for a certain difference in outlook and is one of the main reasons why the application of modern scientific discoveries to the problems of tropical agriculture has been pushed further in Java than in the neighbouring countries.

There are further contrasts to be noted. British Malaya is a very new country and such development as has taken place is largely the result of the efforts of the last thirty years. Ceylon has been continuously under British administration since the end of the Napoleonic wars. Java, having been under British rule during the Napoleonic wars, has been the main overseas possession of the Dutch since those wars and it is only natural therefore that we should expect a greater variety of effort in Java and Ceylon than has yet been found possible in Malaya.

The variety of tropical production obtaining in the three countries can be illustrated by fairly accurate statistics which are available for Ceylon and Java but the agricultural statistics for Malaya are very imperfect, and only approximate figures can be given.

In Malaya there are three main cultures :—

(1) Rubber	2,400,000 acres.
(2) Rice	636,000 do.
(3) Coconuts	492,000 do.

The estimated cultivated area of all other crops in Malaya, such as pineapples, oil palms, fibres, tapioca and maize, probaly does not exceed 100,000 acres—in all a cultivated area of about 3,600,000 acres.

In Ceylon there are sixteen principal crops. The four most important are :—

(1) Coconuts	890,000 acres.
(2) Rice	834,000 do.
(3) Rubber	475,000 do.
(4) Tea	442,000 do.

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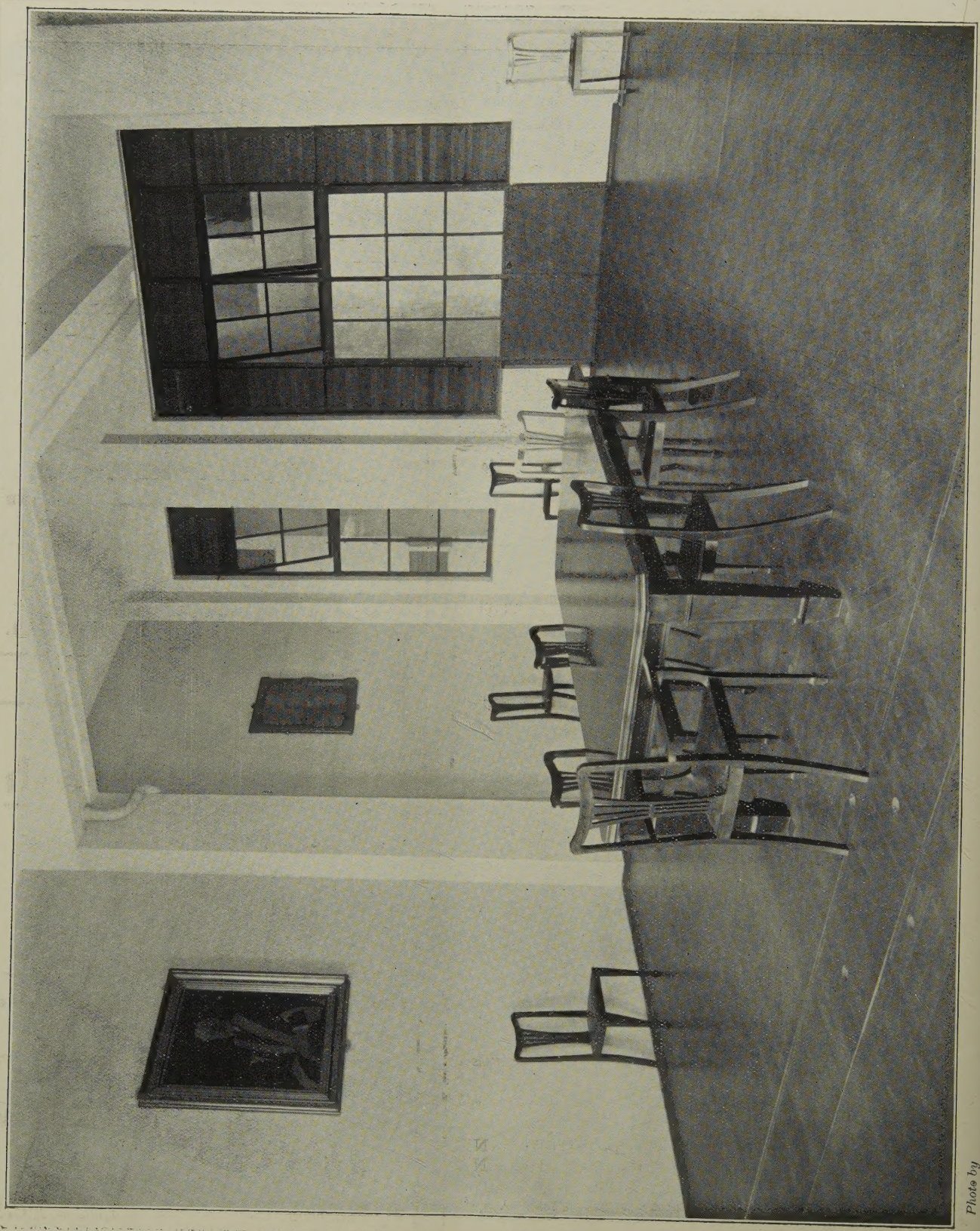
(*See page* 243)



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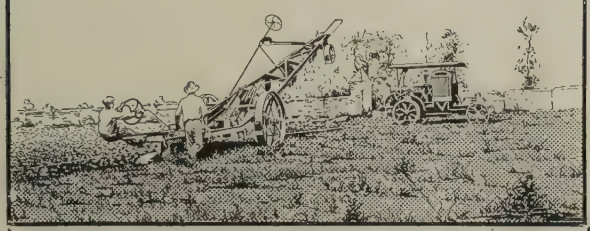

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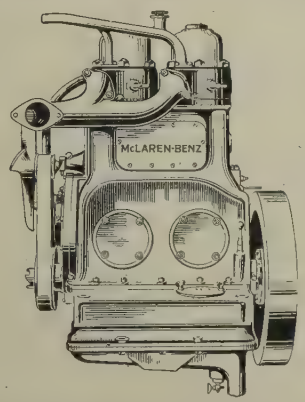

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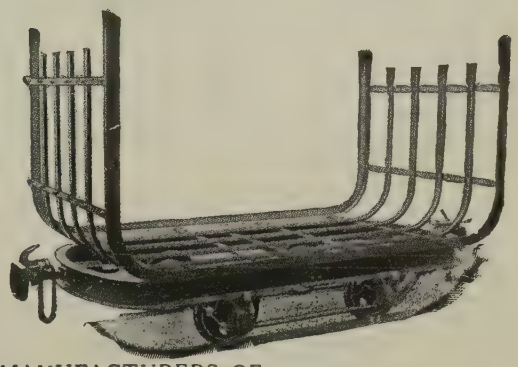

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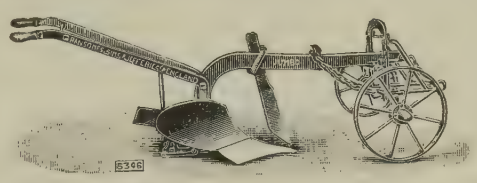

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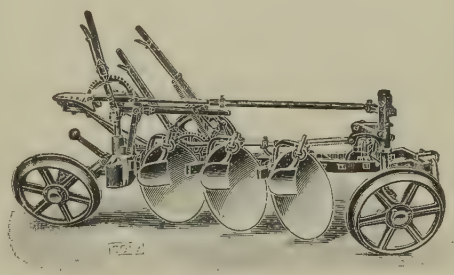

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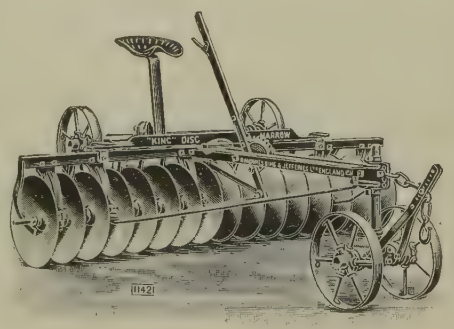

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The other crops are :—sesame, arecanut, palmyra palm, citronella, cocoa, cinnamon, tobacco, cardamous, papaya, cotton, sugar cane, and a great variety of minor grain and vegetable crops. The total developed area of Ceylon is only just over 3,000,000 acres.

The statistics for Java are more complete and must be divided into native agriculture and non native plantations. The total cultivated area of Java, apart from planted forests such as teak, is rather more than 17,000,000 acres, of which 15,000,000 acres are devoted to native agriculture, and only 1½ million acres to European estates. The 15½ million acres are composed as follows :—

Rice	8,000,000 acres.
Maize	4,000,000 do.
Cassava (tapioca) ..	1,800,000 do.
Groundnuts	460,000 do.
Soya beans	450,000 do.
Other crops	790,000 do.

The European estate area consists of :—

Rubber	445,000 acres.
Sugar	436,000 do.
Coffee	236,000 do.
Tea	209,000 do.
Tobacco	65,500 do.
Quinine	44,500 do.
Cassava	28,000 do.
Kapok	25,000 do.
Coconuts	22,000 do.
Sisal	15,000 do.
Cocoa	11,000 do.
Pepper	3,000 do.

A certain amount of plantation crops of coconuts, kapok and pepper are also included in the native grown area of miscellaneous crops totalling 790,000 acres.

The dominant factor in Java is, of course, the enormous proportion of the Island that is given up to the cultivation of rice. This country, approximately the same size as England with practically the same population, without any Manchesters or Sheffields, without any mineral or secondary industries, practically feeds itself. Over 90 per cent. of the rice required to feed the 38,000,000 people of Java with their staple food, is home grown. Of the 8,000,000 acres allotted to rice, thanks to the hydraulic engineering of the Dutch and to the skill of the native inhabitants in minor irrigation, no less than 7,000,000 acres are under permanent perennial irrigation, and only 1,000,000 acres of rice under rain cultivation. In 1925 the yield of the 7,000,000 acres of irrigated rice fields was no less than 6,058,000 metric tons of rice. To give some idea of what this means in the way of intensity of production it is only necessary to quote the contrast with British India, including Burma, with its vast area and its enormous population. In 1924 British India, including Burma, had no less than 81,000,000 acres cultivated with rice with a total production of only just over 30,000,000 tons, *i.e.*, the yield per acre in Java is considerably more than double that in British India.

But by far the most remarkable tropical industry of Java, where modern scientific methods can be seen carried to their further limits, is in the work of the European sugar companies. Although Java has only a little over 400,000 acres under sugar in any one year, it is the second sugar producer of the world, second only to Cuba, and it attains this enormous crop, amounting in this year to between 2½ to 3 million tons of soft sugar, by getting a yield per acre considerably above that obtained in any other part of the world. In Java sugar is grown upon the native owned irrigated rice fields as a rotation crop once in three years, or, in a few districts, once in two years. All the land other than that of of the factory site is hired from the native owners and the European companies have the use of this land for 12 months at a time only. It then goes back into rice, until it is again taken up for sugar.

The enormous yields and the tremendous profits obtained from the sugar industry are due entirely to the results of scientific research, and not merely to scientific research in the combating of disease and pests, but in the much more skilled scientific work of plant genetics and soil science. It is in the breeding of every new and ever higher yielding varieties of cane, and in the cultivation of the soil both physically and by means of green and artificial manures that the astonishing results have been obtained. The sugar industry in Java was amongst the first to appreciate the significance of science and their great central research station at Passoroean in east Java dates back to the year 1887.

It started in a small way to combat insect and fungus pests and it has grown and grown until it is now the most advanced scientific agricultural station in the world. From the very first it has been entirely financed by the sugar planters themselves and nowadays the cost to the sugar planters of the research station, its staff and its 3,000 experimental plots distributed in different parts of the Island, is approximately £110,000 a year. It has a staff of 50 European scientists of various nationalities and some 200 trained native assistants. It is entirely a private enterprise.

Remarkable as are its achievements in the fundamental study of soil science in tropical conditions, its outstanding achievement is in genetics. There has been ceaseless labour for a period of years to produce not only a cane with an ever higher sugar content but also a cane that will grow and mature quickly, and a cane that is resistant to diseases and suitable to the climatic and soil conditions. This year some 66 per cent. of the total area under sugar in Java has been planted with a cane known as Passoroean No. 2878. This cane is the result of the most elaborate hybridization over a period of years and the most interesting thing about it is the introduction into its ancestry four generations back of one wild cane growing in

the marshes of Java that contains no sugar at all and is not even a sugar-cane, but by reason of the fact that it is a wild cane growing in Java, it is immune from disease and is a robust and fast grower. The selection of this strain in the ancestry of No. 2878 and its effective crossing with various sugar yielding canes to obtain the final result was the outcome of microscopical work on the part of the cytologists on the chromosomes or genetical factors which are reproduced and re-associated in, of course, Mendelian variations, in the various descendants. The net commercial result is that No. 2878 adds 15 per cent. to the yield of sugar per acre as well as the robust characteristics and rapid growth required under the ecological (environmental) conditions.

Although Passoroean is both in scale and quality the finest research institute seen anywhere it is by no means the only important agricultural research station in Java. There are 6 other research institutes maintained by planters syndicates over and above the research institutes maintained by the Government. These 6 private agricultural research institutes are :—

(1) Tea Research Institute at Buitenzorg, founded in 1893.

(2) Rubber Research Institute also at Buitenzorg, founded in 1913.

(3) Coffee Research Station at Malang in east Java.

(4) The Djember Research Station in east Java for tobacco and rubber.

(5) The Quinine Station at Tjinjoroean and a 6th experimental station at Salatiga in middle Java.

The two latter are associated with Government work but the others are wholly maintained by the planters' syndicates. Each is staffed with chemists, geneticists, entomologists, agriculturists, &c., and deals with the whole range of problems arising out of the improvement of the particular crop studied.

The Quinine Station is associated with the big Government cinchone plantation and thanks to the scientific work done there the Dutch have almost a world monopoly in the production of quinine. Here again the most important work has been the genetical work. The Government experimental plantation has approximately 1,000,000 trees under control, the yield of each tree being estimable. The success of the industry has been due to the grafting of the high yielding *cinchona legeriana* on to other stocks followed later by elaborate seed selection.

Over and above these institutions there is the work of the Government Agricultural Department which on the research side is occupied mainly with the improvement of native agriculture and with the problems of soil conservation and green manuring. These last two subjects form one of the principal efforts of the Department of Agriculture in Ceylon and are of immense significance for Malaya and other tropical countries.

(*To be continued.*)

GREEN MANURING.

Green-manuring is a valuable and comparatively cheap method of improving the tilth of the soil and providing additional supplies of plant food. In some cases the manuring crop may be grown during the early stages of the main crop. When this is not possible, the growing of a crop entirely for manurial purposes may mean the loss of a season's revenue from the land. It is therefore desirable to obtain a crop which will give a revenue and also may be used as a green manure. It is particularly desirable in the case of small farmers who have insufficient land to enable them to follow the practice of large estates of treating only a portion of their land each year.

It is important to determine the part of the plant with the greatest fertilising value. It has been shown by N. V. Joshi :—

"(1) That the leaves form about 50-60 per cent. of the weight of the green-manuring crop in the earlier stages of the growth. At later stages, owing to the fall of the older leaves and the increase in weight of stems, they form about 25-30 per cent. of the weight of the whole green manure crop.

(2) That the leaves decompose earlier than the other parts (stems and roots) of the plant or the whole plant.

(3) That decomposition of the green material takes place most rapidly and large quantities of nitrates (as compared with the original amount in soil) accumulate when the moisture content is about 16 per cent. of the weight of the soil.

(4) That the weight of a green manure crop added to the soil varies greatly in different seasons.

(5) That the immediate effect of green-manuring on a succeeding crop is principally due to the leaves of green-manure crops."

The leaves are therefore the most important fertilising part of the plant.

Sunn-hemp, which was being investigated from the point of view of its value as a green manure, (N. V. Joshi, *Agric. Journ.* India XXIII, 86) is normally grown for its fibrous stems. The parts of the plant with the most valuable fertilising properties, namely the leaves and the top, are usually wasted. Sunn-hemp thus fulfils the aforementioned requirements. The fibre produced from the stem supplies revenue while the top and leaves may be ploughed in to act as green-manure. The difference between the yield of subsequent crops obtained by ploughing in the whole plant, and ploughing in the top and leaves alone is hardly significant, it being slightly in favour of the latter procedure. Practically the same results are obtained if the sunn-hemp is allowed to grow for fourteen weeks instead of cutting it, as is usual in green-manuring, at the eighth or tenth week. Any leaves which drop from the plants during the extra period are ploughed in with the other material.

H. H. C.

COIMBATORE CANE STATION.

BY C. A. BARBER, C.I.E., D.SC.

SOME reference to the work of the Cane Breeding Station at Coimbatore in South India was made in the Sugar Supplement of *Tropical Agriculture* published last September; and it has been suggested to the writer that a brief account of the reasons for founding this station, and of the task set before it might be worth recording.

The reason for the interest shown in the sugar industry at this particular period is obscure; and it is impossible, without access to official files, to give the exact course of events which led up to it. The Government of India, however, in its annual surveys of the economic position of the country, has never been quite satisfied with the anomaly that, with two to three million acres or more under sugar-cane, the country has not only failed to export sugar but has taken to importing it in considerable quantities; and thus we find that periodically, say about every ten years, the Government is moved to action. About 1910, the urge appears to have been sufficiently powerful for directions to be issued to the Board of Agriculture, meeting in November, 1911, to make the sugar industry its major question for discussion.

It was pointed out that during the two previous decades the imports of foreign sugar—whether from Mauritius, Austria or Java—had increased from 80,000 tons to 700,000, thus taking large sums of money out of the country. Furthermore, the local factories engaged in making white sugar were decreasing in number, and it was predicted in some quarters that this industry would very likely become extinct in a few years. The indigenous refined product was fast disappearing, and even the foundations of the great gur industry were thought to be undermined, in that imported white sugar was being mixed with molasses and inferior gur, and sold as a superior form of the latter product. It is always difficult to throw back one's mind in time and visualize threatening dangers that have long passed, but, whatever one may now think of the menace last mentioned, the Government evidently had good reasons for evincing an interest in sugar matters.

The Indian sugar industry has for a long time been behind hand in all directions—in its economics, its agriculture and its manufacture—and there was ample ground for the opinion that, in one or other of these directions, considerable improvements might be effected. The Board of Agriculture assembled consisted of about 30 delegates and a like number of "visitors." Members of the Viceroy's Council and other leading civilians connected with the administration were present, and sugar workers were well represented as agriculturists, botanists, chemists and factory experts. A very strong Sugar Committee was formed, and their terms of reference covered every phase of the industry, whether agricultural, scientific or technical—from the making of gur to that of white sugar, from indigenous cultivation practice to that evolved by scientific study; the marking out of possible areas for extension, the distribution of intelligence and the marketing of the product.

The Committee had the advantage in its discussions of several important papers prepared beforehand, those most useful having been written by Messrs. Coventry and Howard of the Agricultural Department, and Shakespeare and Neillson in charge of factories in north and south India respectively.

Although one may have attended many of these meetings of the Board of Agriculture in India, it is permissible in retrospect to wonder how the ground was covered so fully in the short time available; thrashing out the details and presenting a concise report for the consideration of the plenary session of the Board. But within three days the Committee had handed in its report, in such a form that it was easy for the President to adopt the unusual procedure of dividing up the subject matter into sections and formulating eight "resolutions," each being brought before the meeting by one or two members sufficiently at home in their subjects to urge the acceptance of the proposals allotted to them. These resolutions may be arranged in two groups, one dealing with the industry as a whole, and the other specifically with the making of white sugar; and a whole day was devoted by the Board to the discussion.

It was recognised in all hands that the vast bulk of the canes grown in the country, whose cultivation had survived for thousands of years, were of very inferior grade; while the losses incurred through inefficient cultivation and faulty manufacture were deplorable. As a basis for general improvement, it was resolved that a cane breeding station should be founded, preferably in south India, and that an engineer should be recruited to work on improved methods for both gur and sugar making; also, for the benefit of the white sugar factories, that an experiment station should be started in the tract where the greatest development had taken place, both for testing varieties and experiments in cultivation. It is obvious that, with the extreme differences of climate and soil in India, no general agricultural station would be of much use; and this work was very properly left to the existing stations in the various provinces where sugar-cane was an important crop. There was no delay on the part of the Government of India in appointing the sugar engineer and the officer in charge of the cane breeding station, in each case a temporary appointment for five years. The experiment station in the factory area followed after a certain amount of delay, presumably because it was a purely provincial concern, and required the approval of the local government.

It may not be out of place here to give a few intimate details as to the origin of the idea of the *cane breeding* work and the selection of the officers in charge—if the personal note may be excused. This idea must in the first instance

undoubtedly be credited to A. Howard, the Economic Botanist to the Government of India, although it would appear that all through he was heartily supported by B. Coventry, then officiating as Agricultural Adviser. The present writer had nothing to do with it. When, however, he arrived at Pusa for the meeting of the Board, his opinion was invited on the proposal, and he at once agreed that it would be an excellent move; but he was not personally interested, because he had made up his mind shortly to retire, as his term of service was rapidly approaching completion. In a well remembered talk on the subject he was pressed to take up the work, and Howard somewhat bluntly told him that if he did not do so the matter would be dropped at once. The prospect was not altogether encouraging. Thus far, practically all efforts to obtain seedlings in India had ended in failure; and there seemed little likelihood of obtaining canes from other countries which could be acclimatized in north India to replace the cultivator's indigenous varieties: there were already plenty of good tropical canes for those parts of the country which could grow them. But the seedling matter had never been properly studied, especially in south India; and it was the possibility of successfully overcoming the unknown difficulties, in a tract where the flowering of the cane was habitually abundant, which finally prevailed.

The general aim in founding the station has already been sufficiently indicated—to get better canes by whatever means that could be devised. And no instructions were issued at any time as to the conduct of the work, so that the Sugar-Cane Expert (as he was called officially) was left entirely free to make his own proposals, both as to the location of the station and the way in which the problem was to be attacked. The suggestion made to him later that he might find it useful to visit Java did not approve itself, in that the local problem was of an entirely different character from anything that has been done in that country. He was, indeed, placed in a somewhat anomalous position, in that the Financial Member of the Viceroy's Council ruled that the proposed station must for budget reasons be placed under the control of a provincial government, in spite of the fact that the work was for the whole of India. He also ruled that the Government of India had it in its power to pay over a lump sum to Madras for the work to be carried on there for five years. But this arrangement had perhaps one advantage, in emphasizing entire freedom on the part of the officer in charge in developing his course of action: the Government of India could not interfere, and the Madras Government would not. But such a condition, and the fact that the post was "temporary," created a number of minor difficulties, which in spite of Madras's benevolent attitude did not decrease as time went on: there was in reality no superior authority to fall back upon for encouragement and criticism, and the recruitment of the staff was found to be very unsatisfactory.

After some consideration, the location of the station was fixed at Coimbatore; and not on the usual heavy black irrigated cane land, but on the lighter soil irrigated from wells, as this was thought to be more analogous to that in north India. In spite of temporary set backs, the reason why former attempts at raising cane seedlings had failed was soon discovered; and this enabled the line of work on the new station to be narrowed and more clearly defined. There was no necessity for introducing fresh cane varieties from abroad for acclimatization in India, and this part of the work assumed a minor rôle. The whole effort was now concentrated on obtaining *seedlings* likely to be of use in the various tracts in north India, where the great preponderance of the area under cane was located; and it was soon recognized that the seedlings for different parts needed different properties (in certain parts frost resistance was important), so that the work would in time consist of a series of separate projects, adjusted to the local environments.

It was proposed to follow a scheme of crossing the indigenous canes with tropical ones, in order to raise their status, and to introduce wild Saccharums to impart resistance to drought and disease. To form a nucleus of parents, collections were made of the numerous tropical canes which had already been introduced into the country at various times, preference being given to those which had been long acclimatized; at the same time, as full sets of the local canes as possible were obtained from the more important tracts; a work which, however, was by no means completed; and several wild grasses of the Saccharum genus were also introduced, including a number of varieties.

There were many difficulties to be overcome before the piece of land chosen was fitted both for the northern forms and tropical canes, but these were overcome during the first two years. The north Indian canes, however, showed some reluctance to adapt themselves, firstly for the production of flowers and secondly to properly mature their juice. A certain amount of acclimatization became necessary. It must be remembered that the growing season is very short in north India, while at Coimbatore it lasts the whole year round; it took a number of years before the indigenous canes produced juice even fit for making jaggery, although this was not allowed to interfere with the main scheme of work.

The actual seedling work was concentrated into part of the year; and, of course, it required several years before a safe judgment could be made as to the inherent value of any cane seedling raised. These facts allowed time for a variety of studies which bore on the main objective; and a whole set of subsidiary projects occupied the attention of the staff at different stages of the development of the station, so that its "aims" appear to vary from time to time. Without going into the reasons for these projects, the following may be taken as typical, for it would be impossible to give anything like a complete list without a

good deal of study. Determining whether cane seedlings could be grown in India: fitting the station for the growth of indigenous varieties and tropical canes: touring over the chief tracts to learn the local conditions and to collect the varieties grown: classifying the Indian canes: seriously studying the unknown morphology of the cane plants: dissecting the underground systems of branching in all varieties, in order to explain their differences in tillering: examining the underlying causes of the flowering of the sugar-cane: the varying capacity of the different varieties for producing fertile flowers and seeds: the inter-relations between the two general types of cane grown between them and the wild Saccharums: the causes of disease resistance: the root systems of different types, and so forth; all the time attempting to improve the intricate technique of raising cane seedlings with safety and economy, and judging of their probable usefulness for the purpose in view. Many of the results of this work have been set forth in memoirs, bulletins, papers and reports; and these have placed the station in an important position among all countries raising their own cane seedlings.

At the commencement of this paper attention was drawn to the interest always shown by the Government of India in the sugar industry; and it was suggested that there seemed to be a tendency to periodicity in this interest finding expression in action; and it may be of interest for the writer to give his reasons for this idea. When he arrived in India it was being gradually appreciated that serious disease was present in the cane fields in north and south India alike (1899-1901). In the north this had led to the gradual disappearance of the thicker and more juicy type of indigenous varieties, forming the red *ganna*, and in south India the area under canes in the important Godavari district had decreased in a remarkably rapid manner. This led to the founding of the Samalkota sugar farm. The disease was found to be red rot, at that time wide spread over sugar growing countries and generally feared; and a series of improved and more or less resistant thick canes were discovered by selection and gradually distributed throughout India, wherever tropical canes were grown. Ten years later interest revived, and the cane breeding station was founded. During 1919-20 the Sugar Bureau was called into being, and the Sugar Committee presented its report, a document invaluable as regards the information collected on the sugar industry. Unfortunately its ambitious scheme for the scientific study of the whole question did not bear fruit presumably for financial reasons. The time is approaching for another "urge": shall we find it in action stimulated by the report about to be presented by the Royal Commission of Indian Agriculture?

The Editor will be pleased to send a gratuitous specimen copy of *Tropical Agriculture*, post free, to anyone interested in tropical development.

BRITISH HONDURAS CITRUS.

[*Through Professor Clark-Powell's courtesy we are able to publish below extracts from his Report on Grape Fruit Production in British Honduras. He has also promised to write an article on the Citrus Industry in the West Indies which will appear in a later issue of "Tropical Agriculture."*—ED.]

ACCORDING to Professor Clark-Powell the world production of grape fruit has increased very rapidly during the past few years, and is likely to continue increasing for several years as there is a considerable area of fruit planted in various countries that has not yet come into bearing. From figures which were abstracted from the Empire Marketing Board Fruit Intelligence Notes of 22nd February, 1928, it is shown that the importation of grape fruit into Great Britain had increased from 34,318 boxes in 1921 to a total of 606,468 boxes in 1927; the chief sources of supplies being the U.S.A. with 501,314 boxes, British West Indies (47,493), other foreign countries (24,829), South Africa (23,907) and other British countries (8,926).

The bulk of this fruit is supplied by U.S.A. (Florida being their chief producing centre) where a great increase in production *will* occur in the next four or five years as out of a total area of 144,140 acres under grape fruit, 74,607 acres are under trees not yet in bearing. Through the consideration of these figures alone it would seem unwise to encourage further production of grape fruit, but on the two important questions of quality and delivered cost of the fruit in the consuming markets, British Honduras has a great advantage over the U.S.A., South Africa and Jamaica. If the position arises that the quantities of grape fruit offered for sale in the English or Canadian markets are greater than can be absorbed at present prices it is obvious that the market will be ultimately gained by the country that can sell fruit of good quality at the lowest price.

South Africa cannot sell grape fruit in the United Kingdom for less than an average price of 15*s*. a case; California, Arizona, and Florida for less than an average of about 18*s*. a case, while Porto Rico, Cuba and the Isle of Pines can probably not sell for less than 15*s*. a case. Palestine can sell for an average of 13*s*. a case.

In the Canadian markets, the British West Indies, including British Honduras, have a preference of 75c. (3*s*. 1½*d*.) a box over grape fruit from U.S.A., and with a lower cost of production and lower transportation charges, can undersell the producing areas of the U.S.A.

With the exception of its seedling grape fruit which is very poor and the production of which should be discontinued, British Honduras' grape fruit is of the first quality and appearance and there is no better produced in any country. The

cost of production and marketing is remarkably low and the following figures show what can be considered as present average costs :

Cost of production ..	$ .25 per box
Picking, transport, packing ..	.30
Box, paper, nails, strapping making	.50
Railage and Boat to Belize ..	.25
Ocean freight and insurance..	.91 (to London)
London charges	.40
Commission, variable ..	.35 (7½%)
Government Fruit Marketing Agency cost	.16
	$ 3.12 or 12*s.* 6*d.* per box.

Freight charges to Canada or Bermuda are 50c. per box.

With such a low cost of production British Honduras is fully justified in extending her planting and if shipments of the fruit to Great Britain and Canada exceed the demand in the next few years, the competition can be met on the basis of low delivered costs. Also by selling at a much lower price fruit that is equal in quality to the best produced in U.S.A., British Honduras could secure the eastern Canadian markets. The country is fortunate in that its production of grape fruit is negligible at present and that in extending it, it will be possible to avoid the errors and mistakes made by other countries.

The remaining portion of Professor Clark-Powell's Report confines itself to a description of soils, nursery practice, the planting and care of a young citrus grove, the use of fertilisers, cultivation methods, insect pests, fungus diseases, pruning, tree records, varieties, picking and packing operations, and concludes with some general information on the citrus industry in the Colony.

The best soils for citrus cultivation in British Honduras are most abundant in the Stann Creek Valley, as those situated along the lower reaches of the Sibun and Belize rivers are considered too heavy, too shallow and too poorly drained to justify any large scale planting. Growers are advised to choose a medium loam, rich in organic matter, well drained and at least three feet deep. Irrigation and levelling methods as practised in California and South Africa, are not necessary in British Honduras. Owing to the widely differing soil conditions the heavy applications of manures which are essential in Florida, are not required in the Stann Creek Valley, and the outlay in fertilisers is therefore comparatively low. Little information is unfortunately available with regard to the fertility of British Honduras soils, but the author recommends for general trial the practice of "bush-mulching," which consists of cutting weed growth in the grove from time to time during the year, and letting the cut grass remain on the surface of the soil between the trees.

Of the fungus diseases damping off is frequently troublesome when the seedlings are young, but can be prevented by providing adequate drainage, avoiding heavy soils and keeping the seed bed free from organic matter. Gummosis which attacks certain species of citrus trees, chiefly at the base of the trunk and extends downwards on the crown roots is the most serious disease. It is attributed to the presence of water, low and deep planting, low budding, bark injuries near the ground, susceptible root stock, and differences in soil and air temperatures. Prevention is the best cure and an annual or semi-annual inspection of each tree is advised in order that the disease may be found in its early stages, when it is not difficult to treat it successfully. The recovery of badly attacked trees can be greatly accelerated by "in-arching" with small sour orange seedlings.

The "drunken bayman," the "orange dog," the "wee-wee," the rust mite and scale insects are mentioned amongst insect pests and various remedial measures are given to control them.

The importation of nursery trees from foreign sources is said to be unwise, as there is always a danger of introducing new insect pests and diseases (*e.g.* "white fly" from Florida). The best root stock for British Honduras seems at present to be the Seville or sour orange, and as this is known to have given good results it is recommended that it should be used commercially, while other stocks such as the grape fruit, shaddock and rough lemon should be tried experimentally. Sweet orange which is susceptible to gummosis is not as good as the sour orange under the climatic conditions of the country. The growing of seedling trees is a practice that should be discontinued as it has been stopped in all the leading fruit areas of the world. Seedling fruit, besides being of very poor shipping quality, has poor flavour and appearance. It is advised that shipments of grape fruit from British Honduras should be confined to the Duncan and Marsh varieties, and that a reputation for uniform fruit of high quality should thus be acquired by the country.

In his concluding remarks the author states that with the growth of exports of citrus from British Honduras, a great improvement should be made with the warehouse facilities at Belize, and that adequate warehouse space should also be provided at Stann Creek where steamers will probably call in the future. Regular shipments should be made to Canada where British Honduras fruit can be landed at a lower cost than any coming from the U.S.A. All second grade fruit should be shipped under a separate brand, while the brand "Stanrex" should be maintained as representing only high quality fruit. It is suggested that a Conference should be held at least once a year at which all exporters and growers should meet and discuss common problems. If British Honduras will only produce high quality grape fruit and place this fruit and no other on the market at the present low cost, a sound industry of a size limited only by shipping facilities could be established.

G. G.

AGRICULTURE IN MAURITIUS.

November, 1927 to April, 1928—Progress Report.

Weather Conditions.

During the period under review, temperature was in the mean below normal in November and December, slightly above in January and February and slightly below in March. Rainfall was generally defective in November. The first heavy rains of the season were associated with the passage of a distant cyclone north-westward of the Island on 29th December. In January, no cyclone was in evidence in the neighbourhood of the Island ; as a result, there was a considerable shortage of rains. In February, a cyclone passed at a safe distance westward, between the 19th and the 21st bringing an abundant supply of rain. On 10th March, another cyclone passed close to the Island of Reunion, and south-west of Mauritius. Some slight damage, mostly in the way of shredding of leaves was done to the advanced canes by this last disturbance. During the following week, there was, however, a drop in temperature which was distinctly detrimental to the growing crops. Very serious damage to crops and property in Reunion is reported as the result of the passage of this disturbance.

Sugar Industry.

The final factory figures for the 1927 crop show a production of 218,000 metric tons as against a preliminary forecast of 243,000 metric tons. This marked reduction on the estimate which has not been paralled in the absence of some factor such as a late cyclone, is believed to be due, at any rate in part, to deterioration of the principal cane variety at present cultivated, viz.: the White Tanna. This belief is sustained as the result of data collected and surveys made by the Agricultural Department. As stated in the notes furnished in November, it has been shown that *Gummosis* caused by *Bacillum vascularum* is widely present. Subsequent investigations have shown that the cognate disease leaf scald, is also widely present. In this malady the general symptoms resemble *Gummosis* but there is no formation of gum.

As the result there has been a marked awakening of interest in the subject of new cane varieties. The variety trials which have been conducted by the Department of Agriculture have suddenly acquired a greatly increased importance, inasmuch as the few estates which have followed the trials and planted new varieties have shown far better returns than the remainder. Varieties which as the result of trial show marked superiority and are now cultivated on a commercial scale are R.P.6 and R.P.8 originally introduced from Demerara in 1916, D.109, B.6308, B.6450, P.O.J.213, Co.213, and the local seedlings 252/98, 33/231. This is apart from the standard varieties White Tanna, D.74, M.P.55, M.P.33 and M.P.131. Of newer canes the local seedling 2316 stands out after many trials as being of considerable merit, 2716 is also promising while B.H.10/12 also appears well suited to local conditions.

Inasmuch as Mosaic does not exist in Mauritius importations of new canes have been stopped since 1921. With the recrudescence of interest in new varieties, there has been a strong popular demand for the resumption of seedling importation. Being given the risks entailed and after prolonged discussions with representative planting bodies, it has been decided to resume importations on a limited scale and with observance of due precautions. For the purpose the decision was taken to erect a quarantine greenhouse in which all new importations would be grown under observation. For this purpose funds were provided from the newly created Sugar Industry Reserve Fund, and the greenhouse has just been completed. It is located at the Department of Agriculture headquarters at Reduit and is constructed on the same lines as the quarantine greenhouse recently erected at Durban by the South African Sugar Planters' Association, plans of this building having been furnished to the Department of Agriculture through the courtesy of the African Sugar Planters' Association. Steps are now being taken to make a first importation of certain of the new Java seedlings, including the famous new cane P.O.J. 2878.

Simultaneously, plans are being discussed for the improvement and extension of the cane breeding work carried out by the Department of Agriculture, which if they materialise will result in an augmentation of staff, the enlargement of the existing experiment stations, the organisations of two new experiment stations and considerable additions to equipment.

The Phytalus campaign for the past season has just been completed, the results show a slightly lessened intensity of infection in Pamplemousses and Rivière du Rempart, a marked increase in Moka and in Flacq, and about the same degree of infection in Savanne. The total area now infected by the pest is estimated at 40,000 acres, but damage is being occasioned by the pest on about 2,000 acres only. The best and most effective method of disseminating the introduced parasites *Tiphia parallela* and *Scolia oryctophaga* are being studied, and the attempt is now being made to establish a barrage of parasites in the regions not at present invaded by the pest, inasmuch as practically the whole damage tends to concentrate itself in newly invaded regions ; once the parasites are established in infected zones, the damage tends to become negligible. A proposal is under consideration for the appointment of an additional research Entomologist in connection with this work.

It should be added that large scale trials with Cyanogas will shortly be undertaken as an additional means of control.

The recommendations of the Sugar Conference, 1927, are now being followed up. Legislative action has been taken to constitute the Sugar Industry Reserve Fund which provides for representing the Sugar Industry in England, for financing trials with new plant and machinery for visitors to Mauritius of technical men connected

with the Sugar Industry, and for other purposes. The fund is financed by means of an export levy on sugar, and is controlled by a Committee of nine members nominated by the Chamber of Agriculture and other bodies connected with the Sugar Industry. The Chairman is the President of the Chamber of Agriculture, the Director of Agriculture is one of the members, while the Secretary is the Sugar Technologist of the Department of Agriculture.

From this fund the quarantine greenhouse has been provided as previously stated, and arrangements made for the representation of the Sugar Industry in England. Plans are under discussion for the installation of a set of juice scales and molasses scales for control work in a factory to be selected, while it is hoped at a later date that a scheme will be worked out for a complete series of tests on boilers and furnace efficiency. This latter question is under discussion by the Technical Conference organised, as the result of one of the recommendations of the Sugar Conference, by the Department of Agriculture and the *Société des Chimistes* which held its first session at the end of March. This Conference is dealing with a number of technical questions of importance both agricultural and manufacturing and will it is hoped exert an important influence on production.

Tobacco.

The Tobacco Industry has gained in importance. The estimated production for 1927 was over 330 tons; there are now 51 flue curing barns and various brands of locally made cigarettes are now extensively sold. A great deal of work has been done in an effort to organise an export trade and an export grading warehouse has been established under the control of the Department of Agriculture. Simultaneously, measures for the control of tobacco disease have been taken, particularly tobacco mosaic, legislation for the registration of all growers, for the prohibition of ratooning and for the destruction of mosaic infected plants has been enacted and two inspectors appointed for the enforcement of these provisions.

It has been demonstrated by the Entomological Division of the Department that tobacco mosaic is conveyed from certain other solanaceous plants to tobacco, probably mainly by means of insect vector.

A seed farm for the supply of tobacco of pure strain has been established by the Department of Agriculture at Beau Bassin.

The Tobacco Growers' Association has now been incorporated by law and it is hoped that in due course the whole of the produce of the new industry will be dealt with on co-operative lines through the Association.

Fibre Industry.

Practically all producers have now adhered to the Hemp Producers' Syndicate, and the new system of grading and baling are already exercising a pronounced influence on the demand for the product.

Pineapple Canning and Preserving.

Proposals for creating a pineapple canning and preserving factory have continued to attract attention, and a Company is in process of formation for the purpose. The Government has been approached with a view to furnishing some financial support for the project. An appreciable area has already been planted in pineapples in view of the anticipated successful launching of the project.

Live Stock.

As the outcome of discussions relative to the manuring of fields, greater importance may, eventually, be given to the stock on estates. The beneficial results produced by the campaign against Surra has, in this respect, removed considerable uneasiness from the minds of planters and the subsidy granted by Government to the Stock Industry will, eventually, facilitate matters to those agriculturists who will be desirous of increasing their stock. It has now been established that *Stomoxys nigra* is the principal if not the only vector of Surra in Mauritius, and this fly is during the warm weather enormously abundant. In this connection, mention should be made of a fly trap, invented by Mr. Bourgault du Coudray, Manager Ferney Estate, which, after inspection by the Government Veterinary Surgeon, is reported to be an eminently useful contrivance for wholesale destruction of flies on estates.

Agricultural Education.

The Mauritius Agricultural College continued to operate satisfactorily. There are now 28 students on the books. The recruitment so far is entirely local, and the past students of the College are finding employment on estates and in the Government service. Recruitment for junior posts in the Department of Agriculture is now regularly made from this source; the provision of this means of training has enabled the Department to meet the very heavy demand for extending activity without any serious dislocation of existing efforts; many of the past students also hold responsible positions on estates, and it is certain that in due course it will exercise a growing influence on local agricultural practice. Mauritius, owing to its geographical situation and also to the fact that it is not linked administratively to any other group of Colonies, is so placed that it is off the beaten track, consequently the facilities thus existing to some extent fail to attain recognition in relation to the possibilities which they offer for extension.

An event of some note was the visit to the Colony of Sir Francis Watts which occurred in early December. Sir Francis visited the Department and College of Agriculture and took much interest in the work in progress. He also visited a number of estates and had opportunities of meeting a number of people connected with agricultural industries.

H. TEMPANY.

MYCOLOGICAL NOTES.

Fomes Lignosus.

IN *Tropical Agriculture* for May, 1928, Professor Briton-Jones, discussing Diseases of Limes in Dominica, writes :—

"Before discussing the several factors which have contributed to the epidemic in Dominica, it may be noted that on several of the diseased roots examined there was found a mycelium growing on the bark which agree with descriptions of *Fomes lignosus*. It is not possible, however, to identify this white mycelium from many others. Dead stumps and trunks of lime trees left lying about on the ground after the trees had died were invariably found to develop the fruiting bodies of *Fomes lignosus*. They have also many times been observed in the dead halves of branches still on the trees. Thus there is as much evidence for the parasitism of *F. lignosus* as is given by Petch [Diseases and Pests of the Rubber Tree, 1921]. This fungus has also been recorded as a parasite of Cacao. It is extremely common on felled Castilloa rubber trees in Cacao plantations in Trinidad, and although close watch has been kept on it for a year or more in certain sections, no sign of the spread to Cacao has been observed. At present it is not eliminated entirely as a possible factor, but these observations strongly support those of Small. It is not a primary parasite and if it contributes at all towards the killing of the plant, it is in the capacity of a very weak parasite. It is of no consequence whatsoever from the practical standpoint."

There are several points in the above account which do not agree with Ceylon experience regarding *Fomes lignosus*, but I do not wish to waste space on details. The chief point is that my book on the Diseases and Pests of the Rubber Tree was written, as stated in the preface, "to provide the planter with a means of identifying and dealing with known diseases." Hence the accounts of the various diseases enumerated therein are, in the main, descriptive, and they do not discuss the question, or give proofs, of parasitism.

Proof of the parasitism of the Eastern *Fomes lignosus* was given by Bancroft in a Bulletin of the Department of Agriculture of the Federated Malay States. Objection may be taken to Bancroft's experiments on the ground that his infecting material was a naturally-diseased root of Hevea, and not mycelium of the fungus from pure culture. In such circumstances, it is possible that some other organism, in addition to the Fomes, may have passed from the diseased root to the experimental plants. But all attempts to infect woody plants with *Rhizoctonia bataticola* in that way have failed, and it has been laid down that the latter fungus does not spread by contact. Hence, as between *Rhizoctonia bataticola* and the Eastern *Fomes lignosus*, Bancroft's experiments are conclusive.

The behaviour of "*Fomes lignosus*" in cacao in the West Indies is evidently quite different from that in Ceylon. In one case in Ceylon, on a mixed estate of cacao, rubber, and coconuts, a rubber tree at the head of a small valley was attacked by *Fomes lignosus* and died, and no treatment was applied. The mycelium spread down the valley, killing all the cacao and coconuts in its path.

The difference between the behaviour of the fungus in the East and West Indies respectively, judging from published experience, is so striking that some explanation is needed. The explanation is quite simple. The *Fomes lignosus* of the West Indies is not the same fungus as the *Fomes lignosus* of the East Indies.

For some time I have been endeavouring to clear up the identity of our tropical root disease fungi, and a paper on this subject, written in 1926, will, I expect, shortly appear in the Transactions of the British Mycological Society. Van Overeem gave a lengthy list of synonyms of *Fomes lignosus*, but he merely collected the various suggestions which have been made by mycologists who have tried to remedy the confusion which exists as regards tropical species, and he did not take the essential step of examining the type specimens. Hence his work is purely literary. Even as regards Javan fungi, as his figures show, Van Overeem failed to distinguish between *Fomes lignosus* and the common saprophytic *Polyporus zonalis*.

From an examination of the type specimens in the Kew, British Museum, and Paris herbaria it appears that the correct name of the fungus which is known as *Fomes lignosus* in the West Indies is *Polyporus microporus* (Schw.) Fr. It is apparently a common fungus on fallen branches, a habitat which, in my experience, is unknown in the species which passes under the name of *Fomes lignosus* in the East.

I have not yet seen the type of the true *Fomes lignosus*, which is in Herb. Berlin, but from the opinions of those who have seen it, it is the same as *Polyporus microporus*. In that case, West Indian mycologists are not wrong as regards the species in using the name *Fomes lignosus* though the earlier name, *Polyporus microporus*, should be used, and the name *Fomes lignosus* discarded as a synonym.

But the Eastern fungus is not the same species, and hence it cannot be known either as *Polyporus microporus* or *Fomes lignosus*. The statement that the type of *Fomes lignosus* (Klotzsch) Fr. came from Mauritius appears to be a mistake. Klotzsch described in the same paper specimens from Mauritius, India, North America, and St. Vincent, but he did not give a locality for *Fomes lignosus*. It is quite as likely to have been from the Western Hemisphere as from the East.

To sum up, the position appears to be that :—

(1) *Fomes lignosus* (Klotzsch) Fr. is a synonym of *Polyporus microporus* (Sw.) Fr., and should be discarded.

(2) The fungus known as *Fomes lignosus* in the West Indies should be known as *Polyporus microporus*.

(3) The correct name of the fungus which is called *Fomes lignosus* in the East Indies is not known.

T. PETCH.

TROPICAL WORLD NOTES.

Gambia.

According to Captain Sir Cecil Armitage, K.B.E., C.M.G., D.S.O., who read a paper lately to members of the Royal Society of Arts, the Gambia is but an enclave of French Senegal, into which it extends eastwards for a distance of about 250 miles along the banks of the Gambia River. The total area of the Gambia is about 4,000 square miles, of which the Colony claims but sixty-nine.

The population of the Colony which consists of the Jollof, Mandingo, Sarahuli, Fula and Jola tribes may to-day be estimated at a little under a quarter of a million. As agriculturalists and farmers they are an amenable, contented and lovable people, among whom the worst forms of crime are of rare occurrence, while that of the more venial kind is steadily on the decrease.

The cultivation of the ground-nut is almost universal and constitutes the main industry on which the prosperity of Gambia depends. A peculiar feature of the industry is the influx, during the yearly sowing season, of Senegal natives in large numbers. These are known as "strange farmers" who, in return for the work that they perform on their host's farms, in addition to their own, are fed by our natives. They return to their country after disposing of their crops, with the wherewithal to pay the annual tax levied on them by the French Government. The construction of railways by our neighbours that will eventually surround the Gambia and deprive it of its labour supply, has already made its influence felt, for the number of "strange farmers" visiting the protectorate has fallen steadily from 24,000 in 1921 to 14,000 in 1926. The establishment of an Agricultural Department in 1924 has, however, counteracted this serious loss of labour, for whereas a crop of but 39,000 tons was recorded in 1924, crops of 59,000 were reported in 1926 and of over 60,000 in 1927, as the result of the stimulus given to the "home" farmers by that Department, which did not confine its attentions to the groundnut crop alone, but succeeded in encouraging the natives to produce increased food supplies which resulted in 1926-27 of a harvesting of cereals—guinea corn, maize, millet and rice—that was pronounced as being "wonderful" and of a size seldom before seen in the Gambia. Farming in the Protectorate is not unattended by difficulties, for the plantations are frequently devastated by the raids of baboons, monkeys, wart hog, and even of hippopotami, while clouds of birds descend on the ripening cereals and keep a small army of children employed in driving them off.

Palm kernels and hides are also exported from the Gambia, but are to-day almost negligible as a source of revenue. The large herds of cattle that were once possessed by the Protectorate natives have been decimated during recent years by epidemics, which appear to originate in Senegal. —(*Journal of the Royal Society of Arts*, Vol. 76, No. 3944.)

British Solomon Islands.

Statistics from the 1926-27 Colonial Report, No. 1370, show that the total revenue of the Protectorate for the financial year ended March, 1927, was £77,445 as against £71,430 for the previous year, while the total expenditure was £63,740 as against £60,330. The chief export is Copra, the value of which is put at £411,597 as against £369,283 in 1925.

* * *

Paraguay.

Cattle raising, agriculture and the exportation of forest products are the chief industries of Paraguay. The value of animal products has risen from £605,910 in 1903 to £1,022,838 in 1926, and of fruit products from £1,009,403 to £1,297,683 for the same period. The value of agricultural products has fallen fron £864,207 in 1922 to £763,041 in 1926. Animal products, which consist of meat extracts, meat flour, dried and salted hides, &c., are chiefly manufactured by three meat preserving plants. The main agricultural products are tobacco, ginned cotton, cotton-seed, mandioca, groundnuts and other root crops, while maize, beans, rice, &c., are raised for local consumption. Both cotton and tobacco raisers have suffered during the last two years from lack of rain and low prices, and the long continued drought has brought serious losses to the agricultural community. Cattle raising is generally regarded in Paraguay as a sound investment, yielding from 10 per cent. to 25 per cent., and good grazing land is obtainable from 3*s.* 6*d.* an acre upwards. Climatic conditions evidently lend themselves to the growing of citrus trees, a great majority of which are wild, and some two hundred million oranges were gathered in 1926.—(*Board of Trade Journal*, Vol. CXX, No. 1644.)

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Bechuanaland.

While the Protectorate's expenditure (Colonial Report, No. 1379) in 1926-27 amounted to £108,222, the revenue which is said to be a record was £131,568. The chief industry is cattle rearing, but owing to stringent veterinary regulations and to the fact that cattle exported to South Africa must be of a standard weight and that the number exported to Southern Rhodesia is restricted, the cattle trade is not as flourishing as it might be. Good prices however for Protectorate cattle have been maintained and the total number of animals exported during the year amounted to 31,889. Hides and skins show an increase from £29,768 in the previous year to £45,258. The Dairy Industry is most promising and 345 creameries had been registered by the end of March while the export of cream was valued at £26,535 as against £22,082 in 1925. Exports of cheese and butter are also growing.

Porto Rico.

The chief features of the economic position of Porto Rico during last year were that the value of its agricultural exports was nearly double that of 1913, that the general volume of trade approached the 1920 records, that the yield of sugar has advanced by 50 per cent. in the last three years, and that there was an unusually large crop of tobacco, the quality of which, however, was poor. The yield of coffee is declining and the 1928 crop is estimated not to produce more than 15,000,000 lb.

It is stated in *Commerce Reports* (Washington, D.C.) that in view of the smallness of the coffee yield it is expected that there will be increased importation of foreign coffees to supply local needs in order that as much as possible of the Porto Rican blends may be released for export at the advantageous prices offered.

During 1927 Porto Rico maintained a favourable trade balance amounting to $6,877,000. Trade with the United States amounted to $183,221,000, or 90.7 per cent. of the island's total commerce. No figures other than total value of imports are yet available to show the importations into Porto Rico from foreign countries, but there are signs of increasing European competition with the United States.—(*The Chamber of Commerce Journal*, Vol. LV, No. 740.)

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Kenya.

The Eighth Annual Report of the Department of Agriculture, Kenya Colony, states that coffee in the year ending 31st July, 1927, made up 32.4 per cent. of the total value of agricultural exports. The total quantity of "clean" coffee produced was 138,264 cwts. and of "buni" 13,261 cwts. or a total of 151,525 cwts.

The prices realized in the London market for Kenya coffee in 1926-27 averaged 117*s.* 2*d.* per cwt. as against 110*s.* 8*d.* in 1925-26, 137*s.* in 1924-25 and 101*s.* 3*d.* in 1923-24. The total amount of coffee exported has risen from 66,150 cwts. in the year 1919-20 to 1,670,713 cwts. in 1926-27 with corresponding values of £201,150 and £816,709.

The Report states that "the area under tea is now given at 3,156 acres, compared with 1,689 acres in the previous year, an increase of 1,467 acres. It is estimated that 2,497 acres will be planted in the succeeding year. 8,700 pounds of tea were produced during 1926-27."

* * *

The Kenya Legislative Council has agreed to the building of two important branch railway lines—the first, 30 miles long, from Kisumu to Yala in the North Kairondo, traversing the native reserve, the second, 47 miles long from Gilgil, a station on the main line, to Thomson's Falls. In both cases the Government will guarantee interest and redemption.

South Africa.

The following is the first preliminary estimate issued by the Department of Agriculture of the maize crops for the 1927-28 season, in bags of 200 lb. net:—Cape and Transkei, 2,677,702, Natal, 2,616,780; Transvaal, 8,554,893; Orange Free State, 7,777,866; total 21,627,241. The excellent rains experienced during January and early February throughout Natal, the Transvaal, and the Orange Free State, and those Cape districts bordering more or less on these provinces, were, with the exception of the coastal districts of Natal and Bechuanaland, followed by a period of drought during the latter half of February, which, it is feared, has seriously affected the yield of maize in certain areas as the crop was caught at a critical stage of growth. The droughty conditions in the south-western half section of the Cape Province have, with isolated exceptions, been accentuated by another month of drought. Losses of stock through poverty and disease continue, and in many cases farmers cannot trek owing to the low condition of their stock. The position is acute in the middle west coastal districts (including Calvinia), a large portion of the south coast, the southern and central Karroo, and the lower border districts.—(*Times Trade and Engineering Supplement*, Vol. XXII, No. 511.)

* * *

Leeward and Windward Islands.

According to Reports for June, 1928, received from the various Departments of Agriculture, it appears that the young canes have suffered to a great extent from the dry weather generally experienced on these Islands.

* * *

In St. Lucia the sugar output is estimated to be less than in 1927. Cacao trees are flowering well, and there is a promise of a good crop. Limes are ripening slowly owing to the dry weather, which however, has checked wither tip disease and prevented blossom blight generally.

* * *

In St. Kitts, the Basseterre factory has already made 18,000 tons of sugar, but is expected eventually to turn out 19,700 tons. Cotton harvesting operations have begun, but, owing to the drought the crop will probably be a small one. The pink boll worm is not as prevalent as it was last year.

* * *

In Nevis both the cane and cotton crops have been reaped. From returns received the acreage planted under Cotton was 876 acres, of which 538 acres were grown by 566 small growers. The crop was practically free of pink boll worm and is estimated to yield 106,000 lb. of lint.

* * *

In Dominica the red root disease of limes is still spreading and the situation is critical.

CO-OPERATION IN CEYLON.

MR. W. K. H. CAMPBELL, Joint Registrar, Co-operative Societies, has written a Supplementary Report on Co-operation in Ceylon (Sessional Paper xxi, 1927) the conclusions of which are equally applicable to most of the systems established in the Crown Colonies.

The position in Ceylon, as already noted in *Tropical Agriculture* (Vol. V, No. 1, p. 11) is far from satisfactory, and it is greatly to the credit of the responsible authorities that they have not only recognised this fact but have also taken comprehensive remedial measures. The existing situation is attributed to the fact that Societies were started in 1912 without the guidance of any expert, were subsequently run by a totally inadequate staff, and supervised by officers whose primary interests lay elsewhere. Mr. Campbell claims that co-operation can never succeed as a branch of an Agricultural Department because it requires a degree of intensive education and close supervision which is impossible for anyone other than a whole-time officer with no other claims to his attention. The present writer suggests that, provided the subject is in the hands of a full-time, adequately trained, and experienced officer supported by a suitable staff, there is no reason why the subject should not be under the general control of the Director of Agriculture in order to secure definite co-operation in agricultural matters. If, as should normally be the case, it is proposed to cater for the requirements of non-agriculturists, then the Co-operative Department should certainly be separated from the Agricultural Department.

In 1926 there were three Inspectors, three additional Inspectors have been appointed, and another six promised during 1928, and yet even with this additional assistance the Registrar finds it difficult to keep pace with requirements. As a result of inadequate staff and insufficient supervision, several defects have become manifest. Members regard the Societies merely as cheap-money lending institutions, and fail to appreciate the functions of the Societies as a bank for the deposit of savings of members and others. There is, in fact, no attempt to mobilise the unemployed capital of agriculturists for agricultural use. Applications for membership and for loans, the use of loans and repayment of money borrowed, have not received the close supervision essential to success. Long term credit has been disguised as short.

A prime cause of difficulties has been the exaggerated ideas of the standard of education and intelligence necessary to enable office bearers to run Societies. As a result Societies with unlimited liability were extended over areas so large that the close mutual knowledge and supervision so essential for successful co-operation became impossible. Some members of some Societies do not even know each other by sight! Meetings are ill-attended owing to the time and money involved in covering the intervening distances. It was always realised that such Societies were fundamentally unsound, and it was intended subsequently to sub-divide them. The sub-division of a Society which has been functioning for some time is a very complicated and difficult operation and owing to the rapid growth in the number of Societies, the staff was never in a position to effect the necessary sub-divisions. For safety, control became vested in headmen, who alone were capable of exercising influence over the whole of so large an area. This has tended to destroy the democratic nature of co-operation and prevented members from attempting to run their own Societies or keep their own books and accounts. Control appears to have passed into the hands of those disinterested in its benefits.

Another striking feature, characteristic also of Societies in other Crown Colonies, is the fact that no serious attempt has been made to meet all the legitimate requirements of members. If they can obtain only a fraction of their requirements from their Societies, the rest must be borrowed from moneylenders. An individual who does not earn more than it costs him to live should be excluded from a Society altogether until the balance has been redressed. Membership must therefore be confined to men economically sound and of suitable character, who should be financed for all their legitimate requirements. The Report for 1925-26 shows a working capital per member of only Rs. 24, and the total deposits and borrowings less than the share capital. Members found it necessary to supplement their credit from the moneylenders whose activities in securing repayment have resulted in a distressing percentage of defaulters among the Societies. In the Eastern Province the policy was different and members were financed with great courage. The working capital per member in that Province is Rs. 89 and, in the rest of the island Rs. 18.

Lack of education and supervision would have made it extremely dangerous to finance Societies to their full requirements. In general, members pledged their unlimited liabilities and got little or nothing for it. Many Societies existing for eight to ten years still have a Rs. 50 or Rs. 100 limit of loans. In the Eastern Section members were recklessly financed for enterprises definitely not economic propositions. As a result nearly all the members of many Societies have overdue loans and remedial measures are difficult since members will not attend meetings.

A Society's borrowing power is limited to three times its paid-up share capital plus reserve fund. This is fundamentally wrong since it implies some relation between the share capital and the security for the loan. The real security lies in the material wealth owned by all the members of the Society, pledged jointly under the unlimited liability. There should exist a register setting out the financial position of every member which

coupled with a survey of the conduct of the members in the repayment of loans, and the degree of their Co-operative understanding, should form a proper basis for estimating the borrowing power of a Society.

The energies of the present staff are, rightly, being devoted to consolidation. Seventy Societies beyond hope of regeneration, which have not functioned for years, and have a mass of overdue loans, have been cancelled, while the fate of others is under consideration. Mr. Campbell emphasises the very important fact that the former staff was inadequate to reveal the true state of affairs, otherwise these Societies would have been liquidated long ago. The cancellation of these Societies will release energy for more productive work.

The formation of Central Banks is to await the consolidation of a thoroughly sound system of primary Societies.

A policy of de-officialization is to be followed and ultimately it is hoped that the official staff will confine itself to its statutory duties of registration, audit, and liquidation, while organisation, supervision, and propaganda will be in the hands of unofficial agencies. To this end an attempt is being made to get members of the Societies to perform the secretarial duties.

A definite attempt has been made, by the formation of a Union in the Colombo District, to establish Supervision Unions. It is recognised that the size of the present Union is too large and will have to be modified. This should subsequently relieve the official staff of a large proportion of the work at present performed which does not rightly come within the sphere of its activities, and tend to convince members that the Societies are not Government Institutions.

The redemption of old debts of members by loans from Societies is a matter requiring extreme caution. In the past enthusiasm has run riot and loans have been granted for the purpose of paying off debts resulting from past extravagance and improvidence without calling upon the debtor to make any considerable personal effort. Such assistance is apt to be demoralizing and, unless evidence is furnished that he will not borrow again outside the Society without its consent, should be left severely alone.

Mr. Campbell urges that those taking charge of Co-operation must be specially trained, and a high standard of general intelligence and education without this is useless. Co-operators must have sufficient enthusiasm to sacrifice personal comfort and convenience.

Judgment of results cannot be made by mere figures. There is not the least difficulty in showing year after year a steady increase in the number of Societies, membership, share capital, reserve fund, &c., though actually the true Co-operative level may be getting lower, not higher.

Mr. Campbell's report is a valuable one. It would, however, be interesting to know what he considers the legitimate requirements of members. The present writer's investigations suggest that in general, the peasant's indebtedness is governed largely by his ability to borrow. His desire to borrow is largely determined by non-economic motives. Would he, to give a particular example, consider the heavy expense of an East Indian marriage a legitimate requirement, or would he restrict loans to productive purposes? In most cases the East Indian does not possess the necessary reserve to enable him to effect a marriage without borrowing, and if deprived of one source of borrowing he will usually seek another.

C. Y. SHEPHARD.

THE BUDGET AND SUGAR.

THE immediate result of the change in the sugar duties under the Budget resolutions is that, firstly, the home refiners have received a big fillip of which they are taking every advantage and, secondly, consternation is rife in Czecho-Slovakian sugar exporting circles, where it is felt that the new incidence of our import duties will scotch if not kill the large sale of Czecho white sugars to this country that has been a feature of late years.

As regards the home refining trade, nothing further is needed to show the benefits the Budget confers on it than the fact that, almost immediately after, steps were taken by certain closed refineries in Greenock as well as the one at Earlstown, Lancashire, to re-open as soon as possible. In addition, one or two of the beet sugar factories, notably that at Cupar, are re-arranging their procedure so as to be able to refine raw cane or beet sugars and so greatly increase their working span. The biggest and most up-to-date refining houses naturally stand to gain the most by the change. As for Greenock, the new sugar preference should prove her salvation if she makes the most of her opportunities. But it is more incumbent than ever that she now modernize her refining industry in thorough fashion, preferably concentrating in one or two big refineries rather than in half a dozen small ones each with its overhead expenses. If this were done the industry would rest on much firmer ground and be less susceptible to such fiscal or economic changes as are not precluded from political consideration some day or other. On the other hand, if the system which was in parlous existence down to a few months ago is persisted in, the first swing of the pendulum, so to speak will bring back once more all the ills that Greenock has suffered from for years past. For if the present scale of preference is considered to favour the refiners unduly, it may not survive a change of Government. So the present chance is surely too good to be lost.—(*International Sugar Journal*, Vol. XXX, No. 350, p. 289.)

RESEARCH IN HORTICULTURE.

Two memoranda of great interest to all concerned with the cultivation of fruit and other tree crops have been issued by the Empire Marketing Board under the title of "Fruit Growing in the Empire."

The first is by R. G. Hatton, M.A., Director of the East Malling Fruit Research Station, and deals with "Standardisation of Horticultural Material, with special reference to Root-Stocks," and the East Malling Station, as we are reminded in the preface, has by 14 years' study of the problems of root-stocks strikingly affected the culture of fruit in Great Britain.

The whole reason, in most cases, for the use of vegetative propagation in fruit culture, is the necessity for uniformity in the crop, which cannot be obtained if the varieties concerned are reproduced from seed, and the work at East Malling started from the observation that even when vegetatively raised many varieties of fruit trees exhibited extreme variability within themselves, much of which was inherent in the material and could not be ascribed to soil variation or other accidental causes.

Investigation of this variability followed two lines. The first was concerned with plants growing on their own roots, that is to say those propagated by cuttings, layers, or suckers. Here it was found that much of the impurity of varieties was to be traced to ignorance or carelessness which had allowed admixture with individuals of other varieties, though in some cases there was evidence that it had originated by development of "rogue" plants, either from "bud sports" or from accidentally dropped seed. In both these cases careful selection, and propagation only from individuals of proved worth, have served to re-establish pure varieties more profitable to the grower than the contaminated strains.

The second line of investigation, which concerned itself with plants budded or grafted on to a root system not their own, proved much more complex, but it was found that the most important factor was the influence of the stock upon the scion. Many of the stocks used are themselves raised from seed, and overwhelming evidence has been produced that in these cases the individuals vary widely, with the natural consequence that when scions are grafted on to them they in turn exhibit variability. In other words, root-stock varieties do not "breed true" from seed any more than the scion varieties put upon them. Some may be shallow-rooted and some deep-rooted, to cite only one possibility of variation, and the total possible result of such variation is strikingly demonstrated in the memorandum by two photographs of Early Victoria Apple trees 13 years old, on crab stocks. These are in a plot of trees selected from the nursery when one year old for uniformity of growth, yet it is shown that had all the trees been as good as No. 1 the total yield at the end of the 13 years would have been over 51 tons of fruit per acre, whilst had they all been as bad as No. 2 the yield would have been under 10 tons. The actual yield was at the rate of 28 tons per acre.

The applicability of these observations to tropical crops is evident when we remember that cacao, citrus and rubber, to mention only three, are propagated on seedling stocks in the event of their being vegetatively propagated at all.

The remedy in the case of the English fruits has been found to lie mainly in the vegetative propagation of the stocks themselves. This is more trouble than raising them from seed, and naturally more costly, but the results have been found to justify the added expense. Not only is uniformity attained, but it becomes possible to select appropriate combinations for various sets of conditions. To quote from the memorandum :—"In the case of apples . . . . it is already possible to give the fruit grower four different types of tree of any given variety, each one to suit a particular purpose. It is possible to predict with considerable exactitude, over a wide range of conditions of soil, variety, &c., the approximate size to which the tree will grow, the age at which it will come into cropping, and even other factors, such as leaf-scorch, poor root-hold, and susceptibility to Woolly Aphis and other pests. Such factors as drought resistance, and the size and quality of the fruit itself, are also affected."

It is doubtful whether vegetative propagation of stocks could be applied to some of the chief tropical tree-crops. Research is obviously needed to find out. In the event of its proving impossible there remains another line of attack—the raising of pure lines of stocks from seed. It is known in the case of pears and plums at least that some lines of seedlings are less variable than others, and adequate genetic research should be able, in a reasonably short period of time, to produce pure and desirable lines of stocks for crops not amenable to propagation on their own roots.

The second memorandum is on the "Effect of Nutrition on Fruit Quality" by Professor B. T. P. Barker, the Director of the Long Ashton Horticultural Research Station where research has for some years been concentrated along this line. This subject is of importance in connection with bananas, citrus, and other tropical fruits which may in the future attain greater commercial importance than they have to-day.

It is pointed out that, although a considerable amount of knowledge has been secured about the factors influencing fruit in storage and transport, there is one set of such factors, inherent in the fruit itself, which has received comparatively little attention. Two illustrations are quoted. In one case the practical commercial storage life of Victoria plums under standard cold storage treatment was found in four consecutive years to

be six weeks, four weeks, one week, and six weeks respectively. In another case of two lots of apples of the same variety, taken from two different trees in the same garden, less than 25 yards apart, and kept in the same store, one lot lasted till January and the other until May.

The duration of storage life is therefore seen to be influenced not only by storage conditions, but by the history of the fruit on the tree, which includes not only the uncontrollable conditions of weather it experiences but also the largely controllable conditions of nutrition it receives.

A vast field for scientific investigation is thus indicated from this aspect of fruit culture alone, and the need and scope for central Research Stations to do for the tropics what is being done for temperate crops receives one more striking illustration.

E. E. C.

CACAO NOTE.

NATURAL CROSSING AND THE GENETICS OF AXIL SPOT IN CACAO. BY S. C. Harland and G. E. Frechville. *Genetica* IX, 1927, pp. 279-288.

IN this paper the authors present the results of an investigation carried out at the Imperial College of Tropical Agriculture in 1925. The object was to determine the amount of natural crossing which takes place in cacao in Trinidad, and to this end a study was made of the seedlings grown from single pods. It was soon found that seedlings could be divided into two classes according to the presence or absence of a spot, of red pigmented tissue at the leaf axil, or point of junction of the petiole with the main axis. It was further found, by the usual methods of genetic analysis, that the presence of this "axil spot" is due to two dominant Mendelian factors. This being demonstrated, it follows that if a parent tree has no axil spot, none of the seedlings raised from it should show a spot, and if any of them do show a spot, it is safe to infer that those seedlings are the result of cross-pollination. In this way the amount of crossing can be estimated.

Certain trees were available, by the courtesy of the Trinidad Department of Agriculture, from which progenies had been planted out in 1914. One of these having no axil spot was chosen, and 37 seedlings raised from two of its pods all bred true to absence of spot. Among the 1914 progeny of 36 trees, however, 16 showed the presence of a spot. These were natural hybrids, and seedlings raised from them showed the expected proportions of "spot" and "no spot" needed to establish the fact that "spot" depends upon two dominant factors.

From 15 of the remaining trees with no spot, 68 pods in all were taken, and the seedlings from each raised separately. In 47 cases all the seedlings were without spot, but in 21 cases varying numbers of "spotted" seedlings occurred. The proportions of such spotted seedlings were quite irregular and it is evident that each of these 21 pods was the result of a natural cross, some at least of the pollen with which it was fertilized having come from another tree, which possessed an axil spot. In other words, natural crossing had occurred in 21 pods of 68, or in 31 per cent.

Although it was previously known that natural crossing did occur in cacao, it is a considerable advance to have a numerical estimate of its amount, for breeding experiments with a crop subject to about 30 per cent. of such crossing must be differently planned from those with a crop where the percentage is, say, one per cent. We now need to know, among other things, the distances at which this natural crossing is effective.

Another interesting observation which was made in the course of the same investigations was that trees with a red axil spot always have also red pods, whilst trees which have no spot have pods either entirely green or only slightly flushed with red. The former types have also more red in the young leaves and flowers than the latter.

E. E. C.

COLONIAL APPOINTMENTS.

The following appointments and promotions have been made by the Secretary of State for the Colonies during the months of May and June, 1928 :—

Mr. T. C. Cairns, Cotton Investigator, Tanganyika Territory ; Mr. W. D. D. Jardine, B.SC., Live Stock Officer, Kenya ; Mr. D. McIntosh, B.SC., Assistant Conservator of Forests, Sierra Leone ; Mr. I. G. C. Squire, Assistant Manager, Oil Palm Plantation, Sierra Leone ; Lieut. F. J. C. Palmour, Executive Officer, Lands Department, Nigeria ; Mr. A. S. Walford, B.A., Agriculturist, Jeanes School, Kenya ; Mr. H. Earnshaw, Schoolmaster, Agricultural School, Nigeria ; Mr. M. T. Dawe, O.B.E. (Commissioner of Lands and Forests, Sierra Leone), Director of Agriculture, Cyprus ; Mr. W. W. Henderson (Veterinary Officer, Nigeria), Chief Veterinary Officer, Nigeria ; Mr. F. H. Manly (Veterinary Officer, Uganda), Assistant Veterinary Pathologist, Nigeria.

BAHIA COCOA CROP.

THE British Consul at Bahia reports that the cocoa crop for the year ended 30th April last amounted to the record figure of 802,312 bags of 60 kilogs. An approximate estimate of the crop for the year ended 30th April, 1929, is 735,000 bags. The plantations continue healthy and climatic conditions normal, but the forecrop will be late.—(*Board of Trade Journal*, Vol. CXXI No. 1649.)

COTTON STUDIES.

STUDIES OF QUALITY IN COTTON. W. Lawrence Balls, SC.D., F.R.S. (Macmillan & Co., 1928, 21s. net).

Dr. Balls' latest work marks another step towards the end that he has had before him for many years, that of bridging the gap between the producer of cotton and the user of that cotton in the form of yarn. It is described as a sequel to "The Development and Properties of Raw Cotton," an earlier book in which the problem was regarded more from the point of view of the grower; this work describes the author's attempts to analyse the essentials of cotton spinning.

The keynote of the volume, which runs to over 300 pages of print and diagrams, is the emphasis which the author places on the study of the single cotton hair, and the way in which he regards raw cotton as a collection of discrete hairs showing wide variability. The book opens with a consideration of the accuracy of commercial grading, and examples are given to show that while in general, and almost always in the case of cottons with which he is familiar, the grader is extremely accurate in his judgments, he may at times be responsible for considerable error. Dr. Balls then deals with the raw material, describing briefly the life history and growth structure of the cotton hair and emphasising its wide variability, and the first part of the book (Chapters I to V) closes with an account of the methods adopted to estimate this variability and a description of the technique employed.

Part II deals with the properties of yarn, and describing as it does, the complicated processes to which cotton is subjected and the intricate machinery through which it passes, in the formation of yarn, it is, of necessity, highly technical. It covers the most important of Dr. Balls' researches into the relationship between the properties of raw cotton, and those of the yarn which is spun from it. The tentative deductions that were drawn, were tested against a set of thirteen samples of American cotton about the spinning behaviour of which full information was available. It would be impossible here to attempt to describe the tests to which these thirteen yarns were subjected: it will suffice to quote the general conclusions which are enunciated:—

"First, that the strength of the yarn is in every "respect a logical consequence of three chief "properties of the cotton hairs (of which it is "composed).

"Secondly, that samples can be arranged in "various orders of merit, according to the "purpose for which they are to be used.

"Lastly, that while the lea test is a useful "guide to their most likely and usual order, "it is always composite, somewhat indefinite "and may sometimes be quite fallacious."

In Part III, Dr. Balls passes to the question of cotton growing for quality, and emphasises that as the properties of the yarn are a direct expression of the properties of the cotton used, and, beyond a point, incapable of improvement by the skill of the spinner, the quality of yarn is, in the last resort, in the hands of the grower. A guide for this individual will be found in a more exact knowledge of cotton properties, which will enable the industrial behaviour of his cottons to be predicted and consequently their value assessed. The length of the hair has in the past been generally considered one of the most important characters by which the plant breeder was to be guided, but Dr. Balls' researches show that although this is often associated with other good qualities, there are at least three other characters which have more effect in determining the properties of the yarn, namely intrinsic strength, fineness, and slipperiness, from which it follows that in spite of all difficulties, methods must be found for estimating these qualities, rapidly if only approximately, in order to facilitate the reduction of the number of field selections in the Cotton Laboratory.

A final chapter is interesting as depicting the author's ideas as to the transition through which the industry is passing and the future that lies before it. For various reasons, notably the increasing pressure of population on the arable areas of the world, which will be increasingly wanted for the production of food, and the possibility of competition from artificial filaments, especially those made by the regeneration of cellulose, Dr. Balls considers that the industry should more and more concentrate on quality, in which case, cotton, with the advantages it possesses of strength combined with flexibility, would, in view of the increasing demand for it in the form of tyres, and other engineering purposes, probably be able to hold its own. In his own closing words "The Cotton Industry of the future, perhaps smaller, certainly more specialised than at present, will stand—or may fall—by the quality of its product."

An Appendix gives Dr. Balls' views on the organisation of Research work in general, and gradually narrows down to the special field of Industrial Research with which he has been associated for the last ten years, closing with a most interesting description of the work of the Experimental Department of the Fine Cotton Spinners' and Doublers' Association, at Bollington, the organisation of the sections, and the apparatus which is in use, much, indeed most of which has been evolved by the staff to meet their particular needs.

Dr. Balls possesses a marked faculty for presenting his material in an orderly and reasoned manner, and this faculty is exceptionally well displayed in the style and arrangement of this fascinating book, which, packed as it is from cover to cover with data of all kinds, and the calculations and deductions to which they give rise, yet never becomes confused or loses the thread of the argument. The diagrams are good and the cross referencing very complete. It is a book which should be on the table of every cotton breeder.

R. C. W.

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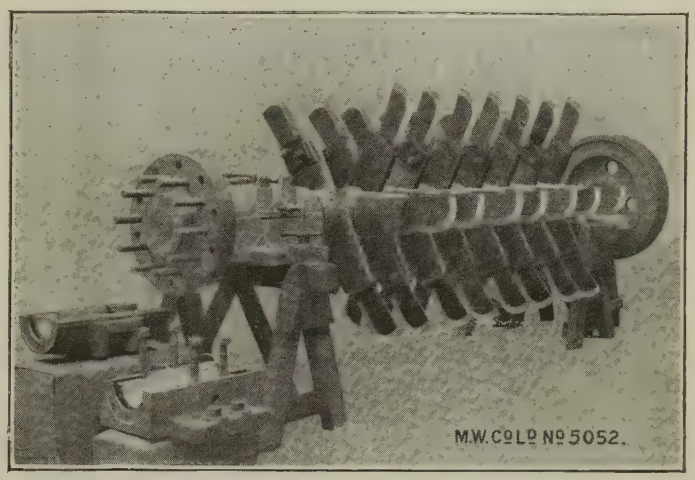

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DISEASE OF CROP PLANTS IN THE LESSER ANTILLES

BY

WILLIAM NOWELL, D.I.C.,

Assistant Director of Agriculture, Trinidad and Tobago (Now Director of the Amani Institute, Tanganyika)

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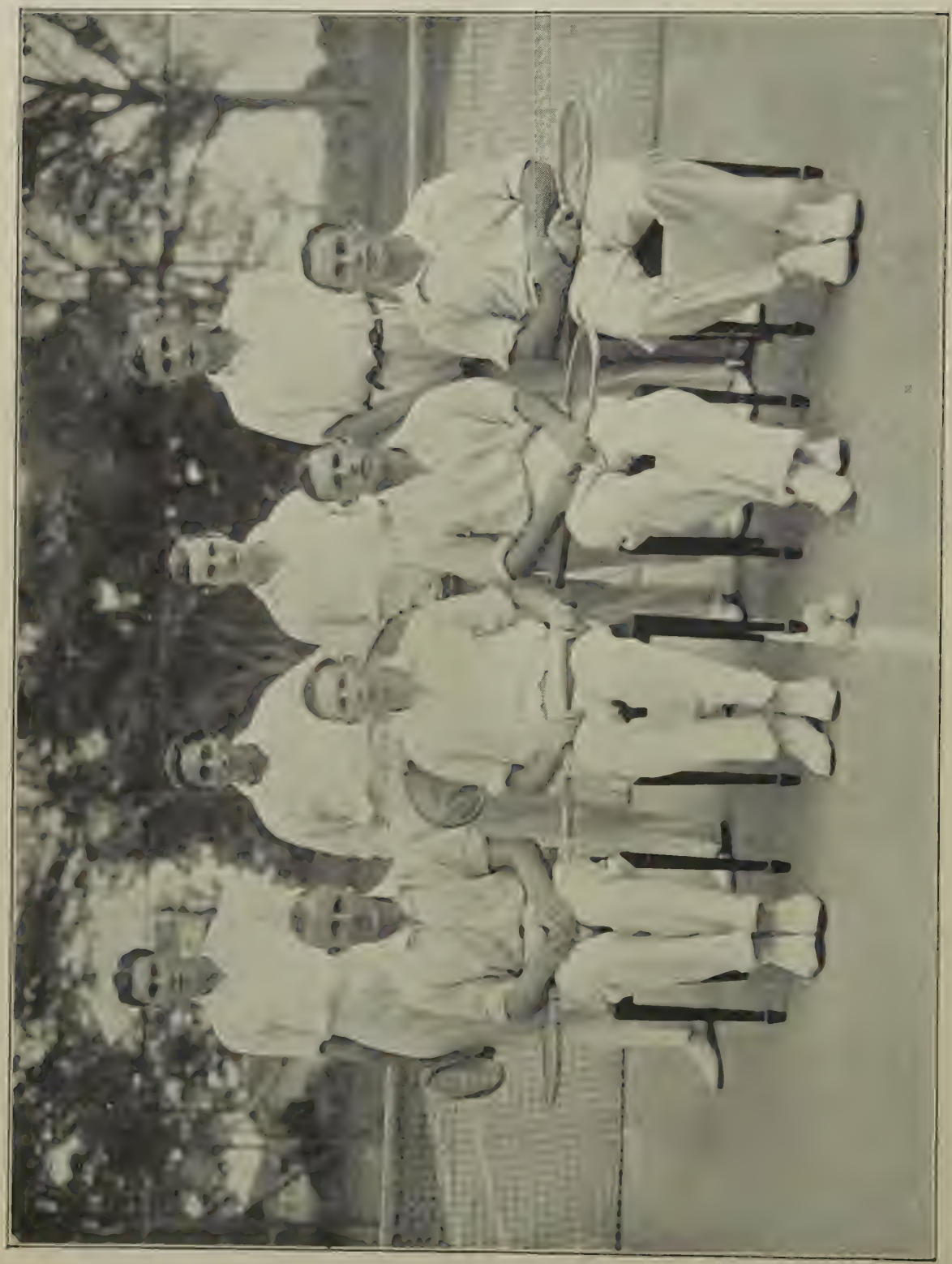

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COTTON NOTES.

G. L. KOTTUR, Studies of inheritance on cotton 1.

History of a cross between *Gossypium herbaceum* and *Gossypium neglectum*. *Memoirs of the Department of Agriculture in India.—Bot. Ser.* Vol. XII, No. 3, pp. 71-133. August 1923.

In this Memoir, the author deals with the results of a cross between *Gossypium neglectum*, a high yielding, high ginning, easily grown type with poor staple, and *Gossypium herbaceum*, which requires a long growing period, varies in staple, and in the long staple types possesses a low ginning percentage. The standard herbaceum cotton grown in the Kumpta district is known as Dharwar No. 1, and has the advantages of quick growth, early flowering and rapid fruiting. The ginning percentage, however, is low (28.5), compared with many other types grown in other parts of India. The neglectum cottons, for example have a ginning percentage of 36-38. The object of this cross, therefore, was to combine the good qualities of Dharwar with the high ginning percentage and early fruiting habit of neglectum.

The experiments were carried out for four generations and at the end, strains were isolated which appeared genetically pure to the new combination of long staple and high ginning percentage. That is, these two characters behave as genetically independent characters. This conclusion, as the author rightly points out, is of very great importance, as it renders possible the production of new cottons which will satisfy the demands of the spinner for good staple, and of the grower, for a high ginning percentage.

It is not, however, with the economic outcome of the experiments that this review is concerned, but with the author's extraordinary method of analysing his data. His treatment of the character ginning percentage may be taken as an example. First, however, it is advisable to discuss ginning percentage in general terms.

Ginning percentage may briefly be defined as lint from lint plus seed and may be expressed by the formula

$$\frac{\text{wt. of lint per seed} \times 100}{\text{wt. of lint per seed wt. of seed.}}$$

Weight of lint usually called lint index is itself a compound character, and may be analysed into number of hairs per seed x mean weight of 1 hair. Number of hairs per seed is dependent on the surface area of the seed and on the proportion of epidermal cells which grow out into hairs. Lint index is thus partially correlated with seed weight, and high lint index is necessarily associated with a large seed, though low lint index is found with both large or small seeds. Mean hair weight is also not a simple character, but depends on the length of the hair, and on the hair weight per centimeter—itself a function of wall thickness.

We should therefore not expect to analyse lint index in simple Mendelian terms, and in reality it is possible to extract from almost any commercial variety, strains breeding true to a large number of different values separated by imperceptible steps.

Nevertheless any marked discontinuity in either seed weight, hair weight or hairs per seed, would result in high and low lint index segregating as a simple pair of allelomorphs. A type of Upland is characterised by completely naked seeds, with sparse lint confined to the chalazal end of the seed. When crossed with normal, high lint weight is dominant and segregation into high and low occurs in a 3 : 1 ratio (*Thadani, Ag. Journ. Ind.* 1923). Segregation in this case could equally well be expressed in terms of number of hairs per seed or as ginning percentage.

In commercial types, however, such marked discontinuity is infrequent, and genetic studies should deal with the separate components of ginning percentage or lint index, rather than with the integrated complex.

Ginning percentage, however, does measure the density of lint hairs on the seed coat, as it is highly correlated with lint frequency, which is defined as the weight of lint borne on a seed of standard size, 100 mg.

Kottur's results may be presented in the form of frequency arrays for ginning percentage.

Ginning %	*Dharwar*	*Neglectum*	F_1	F_2	*Expected* F_2
23	—	—	—	6	—
24	—	—	—	13	—
25	—	—	—	20	—
26	15	—	—	11	3
27	90	—	—	22	22
28	285	—	—	31	71
29	105	—	—	23	26
30	5	10	15	72	14
31	—	—	11	51	8
32	—	5	54	41	39
33	—	20	50	82	40
34	—	40	84	24	70
35	—	60	161	35	150
36	—	150	42	30	67
37	—	140	15	19	45
38	—	55	18	2	26
39	—	10	—	1	2
40	—	10	—	13	2
41	—	—	—	2	—
42	—	—	—	1	—
43	—	—	—	1	—

The explanation which Kottur gives of the above results is that high ginning percentage is dominant over low, and that segregation occurs in F2 into 3 high and 1 low, thus postulating a simple pair of genetic factors. Very ingeniously he divides the F2 curve into two parts, above 29 per cent., and 29 per cent. and below. This, of course he is clearly not entitled to do, since the curve is not characterised by any definite bimodality, or any clear point of minimum frequency. The curve obtained shows modes at 30 and 33, and also transgresses the parental limits in both directions. It is, in fact the usual type of curve frequently encountered in the analysis of quantitative characters, where several genes are involved.

The expected frequency array can be obtained by combining the parental and F1 arrays in a 1 : 2 : 1 ratio, and it will be seen that a distinct bimodal curve results with modes at 28 and 35 and a minimum frequency at 31. Further, the numbers obtained bear no relation whatever to those expected.

No separate frequency arrays are presented for F3 families, so that the results are valueless from a scientific point of view.

The author follows a similar method of analysis for other characters throughout his paper, and arrives at conclusions which are as erroneous, as those about ginning percentage. Thus the frequency arrays for length and breadth of the middle lobe of the leaf, which Kottur divides in such a way as to produce a 3 : 1 ratio, give no support to his theory. The F2 curve for length is irregularly plurimodal and for breadth monomodal.

To sum up : in genetic analyses of a quantitative character, it is illegitimate to classify an F2 into groups except with reference to points of minimum frequency, and then only in curves showing characteristic modality—bimodality for a 3 : 1 ratio, or trimodality for a 1 : 2 : 1 ratio.

S. C. HARLAND.

DAMMAR AND COPAL INDUSTRY.

THE valuable jungle product of dammar is divided by Singapore merchants into two main classes, viz.: dammar and copal, both of which constitute important ingredients in the manufacture of high grade varnishes. Strictly speaking, however, dammar applies only to certain resins, while copal is the name for a local gum which, in addition to its use in high grade varnish is also employed in the manufacture of patent leather, sealing wax and cheap soap.

The collection of the product in the Malay Peninsula is still in a somewhat primitive stage, but rapid strides have been made during the past few years owing to improved methods. According to a recent report from the American Consulate-General at Singapore, the present market for the better grades of copal and dammar is weak and prices have declined considerably. The trade in these resins ordinarily undergoes only small variations, but for the first eight months of 1927 both imports and exports of dammar increased by 25 per cent. over 1926, while copal trade was also somewhat better. Imports of copal in 1926 were 1,356 tons (1,191 tons in 1925), and exports totalled 1,763 tons (2,303 tons). Dammar imports in 1926 were 6,805 tons (5,458), and exports totalled 6,641 tons (7,931). It is considered most improbable that the cultivation of the supply of dammar and copal on a commercial plantation basis will ever be undertaken.—(*The Chamber of Commerce Journal*, Vol. LV, No. 733.)

REVIEWS.

MAN'S ENERGY FOODS.—A Study of Vertical Agriculture and The Significance of Cereal and Root Starches. By Ettie A. Rout (Mrs. F. A. Hornibrook). 16 pages. Reprinted from the Monthly Journal of the New Health Society, 39, Bedford Square, London, W.C.I.

Miss Rout has always been a stimulating writer and is moreover a philanthropist, as I can assert from a long-standing personal acquaintance with her and her journalistic work.

Almost the last time I saw her was on the railway platform at El Kantara in Egypt during the war.

On this sun-drenched, sand-tortured stage she was standing by a zinc foot-bath, filled with fruit-salad for the men and searching with her keen eyes amongst the khaki-clothed crowd that thronged the station for someone to help her in carrying it to the road.

Suddenly she pounced upon a General in the full glory of his crossed swords and cast a spell which compelled him to bend his proud back to the task of taking one handle of the heavy tub whilst she took the other end. All honour to them both !

It is a strange coincidence, but very meet and right withal, that this brochure by a New Zealander should be reviewed by another New Zealander and I take the opportunity of greeting an old friend in a new capacity.

Every page of " Man's Energy Foods " is so full of scientific facts, speculative bio-chemistry and eugenic visions that it makes rather bewildering literature for the critic.

The text is not quite clear as to what the writer means by " ancient native man " but I gather that Miss Rout would like to see the diet of our arboreal ancestors or their early descendants adopted in this sophisticated twentieth century. That the modern diet of civilized countries is lamentable we all admit, but should we not be wiser to look forward to the slow utilization of the facts about nutrition which the laboratory workers are giving us every year in greater numbers and with clearer applicability to our daily needs, rather than cast admiring eyes backwards upon the barbaric feasts of the Berbers, the Polynesians and the American Indians ?

I know the yam, the dasheen, the tannia and the sweet potato both on my table and in the cages of the rats and pigeons in my laboratory and may heaven forbid that I should ever be compelled by any malign fate to adopt any of them as a staple food.

The question of the relative values of germinating and ungerminating grains and tubers, upon which the writer touches opens up a field of work worthy of thorough investigation and of which at present we know little.

The detailed description of the terraced gardens of the Andes and the intensive horticulture rendered possible by the adoption of this system is of great interest as is the statesmanlike suggestion that the unemployed miners of Wales should be employed in adapting the sunny hillsides of that country to increase the national food production by utilizing these waste lands in a similar way.

No one can read the pamphlet without being influenced thereby, but the effect will be a stimulation of mental vision and a keener desire for scientific knowledge of the facts bearing on healthy nutrition rather than a longing for the flesh-pots of Egypt or the succulent uncooked pipis of the kitchen-middens. And that no doubt is Miss Rout's admirable object.

A. CLARK.

* * *

A HISTORY OF VILLAGE COMMUNITIES IN WESTERN INDIA. By A. S. Altekar, M.A., LL.B., Humphrey Milford, Oxford University Press, Bombay. Price 4*s*. 6*d*., pp. xv + 144.

As the author has rightly pointed out, the history of village communities in India is of great importance. Certain authors such as Sir Henry Maine and Mr. Baden-Powell have given us pictures of life in an Indian village at the advent of the British Raj but a systematic history of village communities remains to be written and will entail more research. The author has dealt faithfully with conditions as they formerly existed in certain parts of the Bombay Presidency, but rightly points out that conditions vary greatly in other Provinces and areas of India. He also protests against the theory that is sometimes advanced that these institutions are Dravidian as contrasted with the Aryan origin of communities in Northern India and gives his reasons. For the rest this bulletin gives evidence of abundant research and much diligence on the part of the author.

There is a tendency to set the blame for the decay of village community life to the British Government but it is doubtful, after all, whether many of these changes were not in any case inevitable. The mere effect of a stable Central Government, the elimination of famine, the banishment of isolation owing to vastly improved communications, and the great development of trade, were all bound to have had a great effect. Great changes in the old system would probably have taken place in any case as the result of the vast quickening up of life that has taken place in the last fifty years and which has not left India unaffected. One can, however, sympathise with the author in his desire to see a resuscitation of the more desirable features of the old village communal governments.

G. E.

* * *

INDEX BIOLOGORUM. Edited by G. C. Hirsch. Julius Springer, Berlin, 1928.

A reference volume comprising a "Who's Who" of research workers in biology throughout the world, a directory of biological laboratories gardens and museums, and an international list of biological periodicals.

E. E. C.

A COMPREHENSIVE TREATISE ON INORGANIC AND THEORETICAL CHEMISTRY, Vol. II. J. W. Mellor, 2nd imp., Longmans, Green & Co., Ltd. Price £3 3*s*.

The second volume of this series, dealing with the alkali metals and the halogens, fulfils the promise of the previous volume. Mellor preserves his interesting style and succeeds in listing innumerable facts without causing monotony to the reader. The text is interspersed with quotations from the early chemists, making such a formidable work as this afford entertaining reading. Whether this is desirable in a book that is essentially encyclopeadic and where space is valuable is questionable. The general outlay of the book enforces the relationship between inorganic and physical chemistry. This arrangement necessitates a full acquaintance with the book before full use can be made of the information it contains. A scanty index does not counteract this failing.

The type is similar to that of the smaller volume by the same author, and the use of heavy type in the text to supplement sub-headings is continued with advantage. The diagrams are numerous and well produced. The historical side is dealt with compactly, and the numerous references fulfil the requirements of a work of this nature.

The volume and the subsequent volumes published certainly constitute the premier work on inorganic chemistry yet written, and it will be a long time before it is displaced from that position. The demand for a second impression emphasises the general value of the work.

H. H. C.

* * *

COMMERCIAL RAW MATERIALS—C. R. Toothaker. Ginn and Company, London, pp. 308. Price 8*s*. 6*d*.

This book presents facts in regard to the identity, localities of production, methods of preparation, and uses of the most important commercial products. The compiler is the Curator of the Philadelphia Commercial Museum which possess a very complete collection of the commercial substances of the world. The different sections are headed: foods, beverages, medicines, oils, fats, waxes, fibres, skins, hides and leathers, woods, gums and resins and minerals. As a whole it is a useful reference book for all interested in the raw materials of commerce.

G. W.

* * *

FIRST INTERIM REPORT ON BANKING AND CURRENCY. Stationery Office, Dublin. Banking Commission, 1926.

One of the objects of the Commission was to reassure the minds of nervous people and give them a definite knowledge of what was planned. The above report deals almost entirely with the mechanism of banking.

G. W.

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Soil Science.

The International Nitrogen Conference, 1928.

AT the International Nitrogen Conference, attended by representatives of most European countries, of the United States, and of Japan, a variety of papers were read dealing with every aspect of the nitrogen industry. The main outlet for 'fixed' nitrogen is as artificial fertiliser, and the greater part of the proceedings dealt with that aspect of the industry. Questions such as the relative manurial values of nitrate and ammonium, the inter-relation of intensive soil cultivation and the use of nitrogenous fertilisers, the effect of irrigation and liming on nitrification were discussed. In dealing with the first problem, Dr. A. Demolon stated that the relative value of the two fertilisers depended largely upon the nature of the soil, the climate and the crop. In most cases, a mixture of the two types produced the best result.

The Conference, in conclusion, adopted the resolution that food, clothing and other requisities of a growing population can only be provided in sufficient quantity and without risk of a rise in price if artificial fertilisers are used on an increasingly liberal scale. The growing use of artificial fertilisers therefore constitutes one of the most important means of promoting the well being of humanity.

"Those present at the conference consider it desirable that the following means should be adopted for the attainment of the end in view :—

I.—By the Industry.

(1) Sites for the erection of artificial fertiliser factories to be chosen with a view to production at the lowest possible cost. (2) The fullest use to be made of progress in scientific knowledge and technique in order to improve and cheapen production. (3) Every effort to be made to discover and produce suitable forms of plant-foods and carriers capable of satisfying the varying demands of different plants, taking into account the manifold variations in soil and climate. Among known fertilisers no single one can be regarded as superior to all others under all circumstances. (4) Artificial fertilisers to be delivered to the consumer as directly and as cheaply as possible. (5) The cost to the consumer of all plant foods to be reduced by these means, but not below a level sufficient to maintain the industry in healthy condition, and in a position to continue to secure improvements in its methods of production.

II.—By Agriculture.

(1) Consumption of artificial fertilisers to be increased up to the limit which will give the consumer the maximum economic result. (2) Improved efficiency in utilisation of nutrients by the plant to be secured by comprehensive researches into laws governing plant life. (3) The knowledge obtained by the results of such researches to be diffused by suitable means of education and publicity.

III. By the State.

(1) Organisations for providing consumers with adequate credits for the purchase of artificial fertilisers at low rates to be created and supported. (2) All governments to give special consideration to the economic position of the farmer."—(*Ind. Chem.* IV, 247, 1928.)

* * *

Application of Dry Organic Matter to the Soil.

The heavy application of dry organic matter such as straw or cane trash to the soil frequently has a depressing effect on the yields of subsequent crops. According to the present view, the soil micro organisms increase in activity owing to the increased supply of organic matter. They require nitrogen for their growth and the increased demand deprives plants of available supplies. (*See* this Journal, III, 248, 1926.) This being the case, leguminous plants, such as the soybean, which are capable of deriving their own supplies of nitrogen from the atmosphere, should not suffer from lack of nitrogen in these conditions. Pot experiments to prove this idea have been conducted by Blair and Prince (*Soil Sci.*, XXV, 281). They found that, even with a dressing of straw at the rate of 16,000 pounds per acre, the yields of leguminous crops were not appreciably less than those from control pots. The yields from non-leguminous crops were decreased considerably. Analysis showed that the plants were using the available nitrate supply to the utmost extent. During a year the soil equilibrium was re-established and a second crop of non-legumes felt the beneficial effect of the added humus. A third crop of non-legumes on all pots, including those which had previously grown leguminous plants, showed that the beneficial influence of the added organic matter had apparently ceased. Although the results of such pot experiments cannot be applied directly to field conditions, they suggest that when organic matter containing little or no nitrogen has been applied to the soil, it is advisable either to add available nitrogen in the form of ammonia or nitrate, or to grow first a leguminous crop.

* * *

Synthetic Nitrogen and Chilean Nitrate.

The world prices of nitrogen products have been determined by the Chilean nitrate deposits for nearly a century. F. G. Cottrell has expressed the view before the National Fertilizer Association that the increased production of synthetic nitrogenous compounds is producing fundamental and revolutionary changes in the fertilizer market. The Chilean nitrates are slowly losing their control. In a short time, the prices and production of Chilean nitrate will become subservient to the synthetic nitrogen production, and the latter will be the determining factor in the world's fertilizer market.—*I. E. C.*, 20, 719.

SUGAR NOTES.

Compiled by the College Department of Sugar Technology.

The effect of pH on the Character of the Filtered Juice from Defecated Muds.

The following summarizes an article by J. C. Keane, M. A. McCalip and H. S. Paine (*Industrial and Engineering Chemistry*, 1928, 20, No. 4, 373-376). Some muds are quite readily filtrable and form a firm press-cake with the addition of little or no lime, while others are gummy and difficult to filter unless considerable lime or other filter-aid is added. This difference in the character of the muds is dependent upon variation in certain characteristics of the juice, as well as in procedure. Although addition of lime to the mud improves its filtrability by altering the physical character of the press-cake, it was suspected that certain adverse effects result, especially when the addition of lime is not properly controlled. Lack of information on this phase of factory operation led the authors to conduct a series of laboratory and factory experiments relative to the effect produced on the filtered juice by treating the muds in various ways. Four consecutively filled defecators were selected and so segregated that after the defecated juice had been drawn off, the muds were dropped into two specially prepared mud tanks as a unit. This mud was diluted with water, heated, and resettled. It is the usual practice to add lime to the diluted mud prior to resettling, but this procedure was not followed because lime did not increase the settling rate of the muds in question nor did it improve the quality of the mud tank juice. However, after resettling and decanting the supernatant liquid, the mud was treated with a quantity of lime, heated, and pumped to a separate filter press. Composite samples of each lot of juice were taken and the following determinations were made on each of the above samples: Brix purity, pH, CaO, and colloids by the dye test; in some instances the quantity of colloidal material was also determined by ultra filtration. Coming to the results obtained, although the filtrability of muds is improved by the addition of lime, it was found that large quantities of lime-salts were simultaneously formed. These are detrimental constituents in themselves and, in addition, they were found to be accompanied by an increased quantity of reversible colloids in the filtered juice. This increase in reversible colloids is attributed to peptization of certain constituents of the mud at the higher pH values and the formation of small quantities of colloidal lime compounds. Certain constituents of the juice presumably have already been neutralized and a greater proportion of the dissolved lime remains in free condition, greatly increasing the CaO content of the filtered juice. In double filtration of the juice it is debatable whether the additional recovery of sugar offsets the detrimental effect of the impurities that enter the process during double filtration, the increase in lime-salts being accompanied by an increase in reversible colloids, both of which cause additional difficulty in working the low grade sugar products. Having shown the deleterious effect of the action of lime on muds, the advantage to be gained by decreasing the quantity of lime used at that station is evident. An experiment has shown that diatomaceous earth has possibilities as a substitute for a large portion of the lime required to obtain a satisfactory rate of filtration. Filtered juices from muds treated with diatomaceous earth and a little lime were analysed and found to be comparatively low in lime-salts, reversible colloids (by ultra-filtration), and total colloids by the dye test. Further investigation of this procedure is necessary, however, in order to determine whether greater ease of handling the sugar-end products and any increased yield would justify the additional cost of the filter-aid required. Having shown that excess lime added to the muds increases the quantity of CaO and reversible colloids in the filtered juice, the question arises whether these detrimental substances can be eliminated to any material extent in cases where the filtered juice is added to the raw juice and re-defecated. Results indicated that about 20 per cent. of the CaO present in the filtered juice reacted with the constituents of the raw juice and thus decreased somewhat the quantity of lime required to bring the latter to a given pH value, while 80 per cent. remained in solution during defecation and increased accordingly the CaO content of the resulting defecated juice. Comparing the two procedures from the standpoint of lime-salts, *i.e.*, one allowing the filtered juice to pass directly to the evaporators, and the other returning the filtered juice to the raw juice and re-defecating—calculations showed that the CaO content of the juice entering the evaporators was reduced about 7.5 per cent. by re-defecating the filtered juice. The re-defecation does not, however, cause a decrease in the quantity of colloidal material, since the calculated quantity entering the evaporator is practically the same in both procedures. This lack of improvement is also noted in the apparent purity, there being no change. These results indicate that colloidal material produced in filtered juice by the action of lime on the mud is not removed by further lime defecation. In conclusion it may be stated that it is advantageous to use only sufficient lime to obtain an acceptable rate of filtration, and to add this amount after resettling the mud previous to filtration. This necessitates the exercise of a close control of the liming of the mud. An hourly determination of the pH of the filtered juice might suffice, but an occasional determination of CaO in composite samples of filtered juice should be made to serve as a check on the indirect method. Since reducing the quantity of lime decreases the rate of filtration, it is necessary to establish a practical mean between a poor filtration rate and excessive formation of objectionable substances. It is believed that with proper supervision most muds can be filtered with a resulting juice having a pH

value not exceeding 7.8, and with many muds even less lime can be used. It has been pointed out that double-pressing of muds further increases the impurities entering the process. However, calculated on a solids basis, the quantity of material that may be redissolved in the second filtration is so much less than in the first that the benefits to be derived by careful handling of the muds at the first press station can be readily seen. Likewise, the data obtained indicate that, while a portion of the lime is utilized when the filtered juice is returned to the raw juice, the colloidal material (reversible colloids) formed in the filtered juice is not eliminated during re-defecation. The quantity of filtered juice is about 15 per cent. of the total juice; therefore, when the filtrate is returned to the raw juice the defecation capacity is, of necessity, reduced and it is a question whether the benefits derived are sufficient to offset this loss in capacity. When, however, with good filtration, the resulting juice is maintained at a pH near that of the defecated juice, its addition to the defecated juice appears to be the better practice.—(*International Sugar Journal*, Vol. XXX, No. 354, p. 331.)

SUGAR-CANE IN JAMAICA.

Experimental Work.

INCLUDED in the Annual Report of the Department of Agriculture, Jamaica, for 1927, is a summary by the Director, of 25 years work with fertilisers on sugar-cane in Jamaica. Since these were co-operative field experiments, carried out on sugar estates all over the island, the number of plots in any one series was necessarily small (12 to 16). The number of different fertilisers compared was, however, nearly as great as the number of plots available and apparently only the "No Manure" treatment was duplicated. The results for any one series are consequently of uncertain value and many of the series are recorded as being inconclusive. In field experiments of this type, however, which are intended to serve as the basis of general advice on the use of fertilisers, the accuracy of the individual experiment may be usefully cut down in order that the general conclusions may be based on a wider range of experience, *i.e.* the whole set of experiments, carried out at different places and in different years. The centre of interest shifts then from the individual experiments to the average results for the whole set. It is unfortunate therefore, that in the report under review no average results are presented, nor do the data given admit of their calculation. The general conclusions presented are, briefly, that Lime and Nitrogenous fertilisers are generally profitable, Potash frequently and Phosphates rarely profitable. Sulphate of Ammonia 2 parts and Potash 1 part, are recommended as a standard fertiliser. While conclusions based on so wide an experience must be received with respect, it is not clear by what process of averaging or weighing the favourable and unfavourable results the conclusions have been reached.

In the table summarising the experimental results a note showing the 'practical result' is given for each individual series. Of the 100 series for which results are recorded, 21 were inconclusive, 13 gave no profits and 12 showed a loss due to fertiliser. As against the 25 which showed either no profit or a loss there are 24 series in which a profit is recorded for complete manure (or for nitrogen and potash), and 5 in which nitrogen gave a profit. There are in addition 11 series in which increases are recorded for complete manure (or for nitrogen and potash), but no statement is made as to profit. Judged from these figures the probability of obtaining a profit from the use of complete manure or nitrogen alone, is very low: the odds are only 35 to 30 in favour of a profit (assuming that of the 11 cases of increase noted above 6 were profitable). It is possible, however, that careful averaging of the actual results would show a much higher probability. In the case of lime 20 series show a profit and only one shows a loss: the argument for the application of lime thus appears stronger than that for nitrogenous fertilisers; it is not clear, however, in how many cases liming showed no profit.

On the data as presented no reasonably certain conclusions as to profitable estate practice can be based. In view of the importance of this subject for cane growing it is to be hoped that the present report may be supplemented by a further report giving the average result to be expected from definite manurial treatments together with some estimate of the probability of obtaining that result. The data might also furnish information as to the effect of climate and of soil type on the manurial response.

E. J. MASKELL.

SUGAR-CANE BREEDING.

S. H. EVELYN writing in the *Planter and Sugar Manufacturer* for 26th May, 1928, describes a method of procuring arrow-tassels for breeding work which has proved successful in Barbados.

Cuttings of varieties which it was desired to hybridize, were planted in cement barrels filled with ordinary soil and watered daily for the first few months. Grown in this manner arrows were produced freely from the varieties tested, including Ba 67 which ordinarily only arrows rarely in the locality. Arrows were produced in one case in the short period of six months from planting. A large quantity of viable seed was obtained as a result of cross pollinations in "Arrow-Lanterns" and in open pollination.

The experiments were conducted at an elevation of 1,024 feet above sea level and where the rainfall averages 80 inches per annum. If the method proves consistently successful in the Tropics it should be of much use to cane breeders, providing them with arrows easily handled and supported by an adequate root system.

R. E. H.

COLLEGE NEWS.

A garage has been erected near the Hostel for the convenience of students.

* * *

Mr. H. H. Croucher returned from his visit to St. Lucia by s.s. *Cavina* on 29th July.

* * *

Mr. A. G. Howell and Mrs. Howell sailed for Barbados by s.s. *Van Rensselaer* on 17th July, and returned by s.s. *Cavina* on 29th July.

* * *

We offer our congratulations to Mr. G. Wright who has been awarded the degree of Master of Commerce by the University at Leeds for a thesis entitled the Economic Survey of St. Vincent.

* * *

We have to acknowledge with thanks a useful series of twenty-seven prints showing agricultural operations in Southern India which have been received from the Madras Agricultural Department.

EXAMINATION RESULTS.

1. DIPLOMA STUDENTS.
   (i) *3rd year.*—The following have passed their 3rd year examination and have been awarded the College Diploma :—
   M. S. Aspiazu.
   F. MacG. Bain.
   G. E. L. Spencer.
   (ii) *2nd year.*—The following have passed their 2nd year examination and are eligible to proceed to their 3rd year course :—
   A. L. Grogan.
   R. S. Hanomansingh.
   A. F. W. Sheffield.
   (iii) *1st year.*—The following have passed their 1st year examination and are eligible to proceed to their 2nd year course :—
   E. S. A. Chin.
   C. A. S. Hynam.
   A. F. Nichols.
   C. K. Robinson.
   J. F. Williams.
2. POST-GRADUATE STUDENTS.
The results of these examinations are not yet available.

THE COLLEGE ENTRANCE HALL.

THE photograph on page x shows the Entrance Hall in the central portion of the ground floor of the main building. The portraits are those of Sir Francis Watts, K.C.M.G., the first Principal of the College, and of the late Sir Arthur Shipley, G.B.E., LL.B., SC.D., the first Chairman of the Governing Body of the College. The furniture was the gift of Messrs. Davidson and Todd, Port-of-Spain, Trinidad.

THE COLLEGE LIBRARY.

THE photograph on page ix shows a portion of the College Library, the nucleus of which consisted of the Library of the Imperial Department of Agriculture for the West Indies, the functions of which were absorbed by the College at its formation. With the assistance of a grant of £1,000 from the Carnegie Corporation and the allocation of £5,000 from the grant to the College by the Empire Marketing Board and the Empire Cotton Industries, considerable development has recently taken place. Additional shelving has been purchased, books, sets of periodicals and pamphlets are being bound and a catalogue is being compiled. With the completion of the Chemical Building it is anticipated that more space will be made available to relieve the present congestion in the Library. Valuable books have been presented by several private donors and a large number of publications have also been received from publishers for review in *Tropical Agriculture*.

SPORTS.

(1927-28.) Tennis Retrospect.

ALTHOUGH the standard of play rose very considerably during the close of the summer session, the tennis season which has just ended could not be called a successful one. Of the twelve matches played eight were lost, three won and one was scratched. Much enjoyment was nevertheless derived from the matches played and once the team got accustomed to the asphalt courts the margins of the defeats sustained were much reduced and in some cases there were some very close struggles. The teams played were St. Augustine, Tranquillity, Trinidad Leaseholds and Caroni.

A Doubles Handicap Tournament was held, the finalists being Savile and Sheffield (scratch) *v.* Nicoll and Pieris (owe 30), the latter winning 6-2, 6-8, 6-0. A Singles Handicap was also held, the finalists being Nicoll (owe 15 4/6) *v.* Birkett (owe 15 3/6), the latter winning 6-4, 6-4. These tournaments did much to raise the standard of play and it is hoped in future years there will be a Singles Challenge Cup to be competed for annually, and that the formation of a Tennis League will also be considered.

McDonald's prolonged absence on account of illness was a severe loss to the tennis team. Birkett tendered his resignation as captain of the Tennis Club at the same time as that of the Cricket Club owing to pressure of work.

The following played for the College: H. A. Pieris, T. H. Nicoll (*Captain*), L. S. Birkett, A. F. Sheffield, H. H. Croucher, O. J. Voelcker, J. D. Broatch, A. K. Briant.

T. H. N.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—Since our last report quotations have ranged as follows: Foreign *c.i.f.* per cwt. 12*s.* 3*d.* (2nd July), 11*s.* 9*d.* (13th July), 11*s.* 7½*d.* (1st August), 11*s.* 6*d.* (7th August). Preferential *c.i.f.* per cwt. 16*s.* (2nd July), 15*s.* 9*d.* (12th July) 15*s.* 6*d.* (18th July), 15*s.* 4½*d.* (1st to 11th August), The outstanding feature of the week ending. 19th July was the sale by the Cuban Export Corporation of the 300,000 tons Cubas recently withdrawn from the American allocation, for shipment during August-December inclusive, at 2.34*c.* *f.o.b.* Cuba. Practically all of this quantity was sold to British refiners, a few cargoes finding their way to Continental buyers. The *Manchester Guardian Commercial* (19th July) mentions that since the raw sugar duties were re-arranged supplies of Continental refined have dropped almost to vanishing point and the refiners in Czecho-Slovakia have applied to their Government for a bounty in order to help them to force at re-entry in United Kingdom markets.

* * *

COCOA.—Since the last report the terminal market in New York has taken on a somewhat weaker tone, due to unexpected heavy arrivals from producing centres at a time of the year when manufacturers are quiet. Prices for Trinidad cocoa in New York have fallen practically 2 cents per lb. during this period, and in London from 8*s.* to 10*s.* per cwt. With reasonable demand there is every prospect the market should strengthen.—(*By courtesy of the Cocoa Planters' Association, Trinidad.*)

* * *

COTTON.—From 4th to 18th July, the price of American middling showed a downward trend. (Mid. American 19th July 11.97*d.*) This is ascribed to three causes: belated bearishness on acreage report; small consumption in United States for June; better weather and crop accounts from the South. The *Times Trade and Engineering Supplement* regards it as questionable whether poor trade will have any positive effect on the market until the new crop is known more definitely. The *Liverpool Circular* 13th July, reports as follows: African, moderate business; Egyptian, market quiet; East Indian, fair demand; Sea Island, a small business has been done; quotations unchanged.

COFFEE.—Reports to 18th July state that Santos has opened a new coffee season with 1,185,000 bags against 951,000 a year ago, but with higher prices, the result of the national credit voted a year ago. There are no changes on the London market.

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TEA.—The new season is now in evidence. Mid-July averages were as follows: Darjeeling, 17.08*d.*; Nyasaland, 11.97*d.*; Indian 15*d.*; Ceylon, 17.17*d.*; Java, 11.50*d*; Sumatra 13.28*d.*

* * *

RICE.—Quotations, £ per ton, on 18th July were as follows: Carolina, £29; Patna, £28; Spanish, £23; Burmese, £15. Feeding rice was an increased sale at full prices and table rice gained in favour.

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RUBBER.—Since the beginning of July, spot prices, *c.i.f.*, of plantation sheet have ranged between 9*d.* and 9½*d.* (1st to 11th August, 9⅜*d.*-9½*d.*). Mid-July reports state that the market was considerably steadier with more active business passing. The fact that some of the larger American consumers have faith in rubber at its present price is evidenced by the fact that a large business has been passing for shipment over the whole of next year at about 9¼*d.*

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COPRA.—August quotations (*c.i.f.* per ton) for West Indian have been £26 7*s.* 6*d.* (1st) and £26 3*s.* 9*d.* (7th).

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GROUND-NUTS.—Reports for the third week in July state that East Africa was selling Arachis at £21 12*s.* 6*d.* London was paying £39 for crude oil and £43 for deodorised in bulk. There were, however, buyers willing to pay £47 for the same deodorised if they could get it in barrels (5 cwt. non-returnable).

CANADA.

Cocoa and Chocolate.

DURING the 12 months ended 31st March, 1928, imports into Canada of preparations of cocoa or chocolate reached a total volume of some 1,500,000 lb. valued at $200,000. The market is mainly in the hands of American and Dutch firms, but presents good openings for British products. Cocoa butter is in great demand, 5,500,000 lb. being imported in 1926-27. More than half the total was supplied by Dutch firms, while imports from America and Germany showed an increase. The leading makes of British cocoa are making good headway. The chocolate market is much more difficult. The general taste is for chocolate candy, and strong competition is experienced in high quality lines from local makes. Sales of certain well-known lines of British plain chocolate are increasing, as the result of good publicity and distribution.—(*The Times Trade and Engineering Supplement*, Vol. XXII, No. 524.)